REFERENCE LIBRARY

OF THE

STATE TEACHERS COLLEGE

WHITEWATER, WISCONSIN

No. 26049

Bought 9-8 *1930*

Students of the State Teachers College are allowed to draw the books for use at their rooms on the following conditions:

1. No book must be taken from the library until it has been properly charged to the student drawing it.
2. Bound magazines, most Reference books and Reserved books may be taken from the library at 4. p. m. and must be returned at 8. a. m. the following day.
3. All other books may be kept for two weeks.

'alk, Look & Listen!

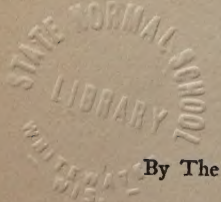
Sign Posts on a Naturalist's Highways

by Raymond T. Fuller

The John Day Company
New York

QH
81
F85

Copyright, 1929, by Raymond T. Fuller
First Published, March, 1929



Printed in the U. S. A.
For The John Day Company, Inc.,
By The Quinn & Boden Company, Inc., Rahway, N. J.

About the Author

RAYMOND TIFFT FULLER was born July 23, 1889, in Syracuse, New York, and lived in the country around Sandy Creek, New York, as a child. The love and intimate knowledge that he has of outdoor life goes back to the time of his boyhood there.

He studied at the Biological Laboratory at Cold Spring Harbor, New York, and at Colgate University. After being graduated from Colgate he taught for several years in High Schools and Progressive Schools, and in Washington and Jefferson College. He then traveled in Australia and the Orient as representative for a chemical company, and has since made many trips around the world conducting parties on tours.

Mr. Fuller is the author of several one-act plays and has contributed articles to the *Christian Science Monitor*, and to various magazines, including the *Nation*, *Century*, *Travel* and *Mentor*.

see p 103. Bates

Contents

PART ONE: Walk, Look and Listen	1
Foreword	3
Introducing Two Little Owls	5
A Trio of Orchids	12
Mud Wasps	16
About Crows	20
Discovering a Spadefoot Toad	25
The Ant Lion at Bay	31
Morels	33
Cocooning and What Comes of It	39
The Seven Sounds	47
Flying Squirrels	66
Telling the Evergreens Apart	68
Identifying Six Turtles	72
Merely a Matter of Taste	75
May Fly Mathematics	81
The Complacent Porcupine	85
The Pixie in the Pansy	90
Katy Did	92
Birth Control in Birds	96
Uncommon Senses	101

Ten Earliest Spring Flowers 109
Insect Suns 111
The "School" of the Sycamore 115
The Red Crossbill 118
Have You Seen a Wild Fox? 121
Knee-deep in Marsh 128
Getting to Know Ferns 139
Mushrooms or Toadstools? 146
'Possums Are Getting Common 152
Hidden in the Air 156
Policeman Kingbird 164
Fishless Aquariums 168
Kings, Queen, and Mimes 173
"Now You Tell One!" 180
Map-making *Par Excellence* 186
A Week's Walk 190

PART TWO: Some Nature Projects for the Modern School 199
Foreword 201
The Observation Beehive 203
An Indoor Anthill 205
Keeping Track of the Sun 209
Doing Something About the Weather 211
Your Own Christmas Tree 213

A Winter Woodchuck 215
A Collection of Snakes 218
The Microscope World 222
A Hint for School Gardens 224
Making Maple Syrup 227
Attracting Bird Guests, Winter and Summer 232
Grasshoppers 238
Schoolroom Pets 241
Frog, Toad, and Salamander Eggs 251
School Forestry 255
Making "C'lections" 262
The Overnight Hike for Children 265
Some School-made Contraptions 273
What One Mother Did: A Museum Laboratory for Children 282
Places to Buy Natural History and Biological Material 289
Book List 291

PART ONE

Walk, Look and Listen!

"It is no use to direct our steps to the woods if they do not carry us thither. I am alarmed when it happens that I have walked a mile into the woods bodily, without getting there in spirit."

—THOREAU

Foreword

A SORT of patriotism, I suppose, has been my real motive for writing this book.

Nearly every American city-zen, even the smallest-villager, shows local pride upon occasion, pride in his town—its streets, buildings, parks, notables, home products—even in the baseball team which bears its name though it contain not a single native son!

This spirit of patriotism, national or local, is almost instinctive in us: we burn to inspire in others the vaunting emotions that swell in our own bosoms.

Similarly, one who frequents not the streets, office-buildings and factories of towns and cities, but the highways and byways of the countryside, likes to "point with pride" to the wild life which he loves and enjoys. Having learned to be at home in the open, he likes to share with others the thrill of his own sense of *belonging* in the woods and fields. He, too, likes to show strangers his own "home town."

So this is a guide-book for town- and city-

dwellers who, when they visit the country, can be induced to "Walk, Look and Listen."

Then, too, there are the children! What parent would not wish them to become more familiar with Nature's ways and less wholly habituated to town and city routine!

"Nature" is, after all, only another word, a euphemism, for life-on-the-earth, vast biological-mechanical system in which man, though he so commonly fancies himself aloof, is a cog. He may boast of having conquered Nature; at times seem to deny successfully the inexorable laws; but he is a part and only a part, and it need not be in humility that he comes to realize it. No doubt but that the growing racial consciousness of this profound fact is the outstanding mental attainment of the age. Any system of education which does not emphasize this truth fails of being practical—and adequate.

For ourselves and our children the accumulation of a broad nature-lore—far more than being a hobby—may be, in fact, attainment of wisdom, evidence of having laid hold upon fundamental things. Actually nature knowledge is an approach; an introduction to *all* the sciences, and to the scientific habit of mind.

Introducing Two Little Owls

A NEW YORK business man said to me the other day: "I *wish* I could *see* an owl—a wild owl! I wish I could show one to my children. *Where* and *how* can I look for one?"

That query, which I have heard before, called to mind a day when I was twelve and already beginning to be a bird enthusiast, and chanced to hear someone mention the word owl. Though I was familiar with perhaps fifty birds, I was suddenly struck by the realization that, to me, an owl was a semi-mythical creature, about which I knew as little as I did about griffins, dragons and rocs. I was chagrined. There *must* be owls in my neighborhood of course; but where did they dwell and what were their habits? Forthwith I delved into books, laid out campaigns and dedicated days and nights to seeking their acquaintance. Now, twenty-odd years later, I offer my experience to those whose interest in owls has in some way been aroused.

Not to touch upon the several big owls just here, I suggest beginning one's search with two

smaller species fairly common throughout the East, year round residents, not given to secreting themselves in dense and distant forest haunts: the Screech Owl and the Acadian. Mind you, I don't *guarantee results,* any more than, having directed a passing motorist as to the route to Binghamton, I can be certain he will finally arrive there.

The Screech Owl's voice is well known. In the country from about mid-September until the end of January, it can be heard nearly every night—a soft, drawn-out, quavering cry hardly to be mistaken. Not a screech, it is rather a sorrowful wail. If you go outdoors softly, and stand so that the bird is between you and a moonlit or starlit sky, you can see it plainly among the leafless branches. Probably the only features you can make out under these conditions are the size, the eartufts, and the frontally-directed eyes of the typical owl-shaped face. Presently, giving a low and vibrating trill quite different from his ordinary cry, he will fly far off, as silently as thistledown. One should preferably seek a daylight encounter.

Almost invariably the Screech Owl spends his winter days in tree-cavities, or woodpeckers' holes, not far from the ground. The actual body of the bird is much smaller than its fluffy plumage makes

it appear: a hole two and a half inches across is ample for its entrance. Occasionally they sleep in deserted barns, steeples, cupolas, sheds—anywhere that it is dark. Three times I have seen a Screech Owl dozing in the arched-over side-opening of a covered brick chimney. What they seek is a quiet, dark, dry nook; they are not too particular where, so long as it is small enough to enable them to conserve their body heat on chill mornings. Persistent delving into such cavities, especially in old orchards, ought ultimately to be rewarded.

Reach in boldly and haul forth your quarry: he will not attempt to bite. Instead, after a pitiful little whine or two, or a peevish clicking of mandibles, he will feign utter indifference and may even go so far as to play dead in your hands. But woe to you if for an instant you relax your grip on legs or wings. Away he slips, wild-eyed, nastily clicking his beak—and you will see him no more that day. The next, however, he may perhaps return and sometimes he can be caught again and again.

When spring foliage comes out and birds begin their nesting affairs, the female owl broods over her eggs, while the male conceals himself near-by in leafy coverts and thicket tangles. The nest hole is usually a counterpart of the winter roosting-

place. In its vicinity a most discreet silence is maintained. During spring and summer the cry of *Megascops asio* is rarely heard. North of the Mason-Dixon Line, the eggs are laid between the first and twentieth of April. Usually six or seven make a setting. Three weeks later the downy babies hatch; by the middle of May the whole lot of them emerge from the nest, crowd onto limbs near-by and sit like statuesque gnomes—appealing and comical beyond measure. Should you wish to catch one of them, now is your time: in a few days they can use their wings and they are hard to catch after they learn to fly.

Screech Owls are not inhabitants of heavily wooded districts. They prefer more open areas cleared by man: orchards, thickets, sugar bushes, and the thinned wood-lots of the farm. One sign which the seeker learns to look for is the presence of owl pellets. These are oval compacted masses formed of the regurgitated hair, bones, feathers and teeth of their prey. All owls bolt their catch whole or in large sections: the process of digestion separates out the inedible portions, and they are ejected from the beak in neat packages. Screechers' pellets are smallest. They are generally less than an inch in length and half as thick, of a mouse-color gray, and inlaid with filigrees of shining

white bones. They are dropped beneath the owls' perching spots in their hunting grounds; a stone wall, a dead tree, a fence post. To find some of them here and there is pretty clearly to establish the locality as a Screecher's range. Somewhere hereabout will be his roosting-quarters.

At other times your ears may be your guide. If you notice a worried, sustained outcry among the small birds at a certain spot—jays, robins, chickadees, towhees, and the like—you can almost be sure that the subject of the disturbance is one of three: a cat, a snake or a Screech Owl. Whenever small birds spy out an owl, though he may be dozing on a limb and strictly minding his own business, they are reminded that he sometimes isn't asleep and that then he is their arch-enemy. The whole bird population of the vicinity will be set agog by the hub-bub—and then comes the bird-lover's opportunity!

A unique feature of these, the commonest owls, is that they occur in two shades of coloration. There is a red type and a gray; just as there are blondes and brunettes among us. Aside from coloration their markings are the same but, if two parents differ in type, the young may be partly of one color and partly of the other. Geographical distribution or time of year *seem* to have no bear-

ing on the relative predominance of one type over the other—but a vital subject of study yet exists in determining this fact positively.

The Acadian or Saw-Whet is a bit rarer than the Screech Owl. It is smaller, and favors deeper coverts. It is a round head owl, having no ear-tufts like Screecher and, whereas the latter's irises are gleaming yellow, the Acadian's are brown. The general coloration is darker than the red-type Screech Owl, being a rich brown, the breast streaked with white instead of mottled. About the only hint that they are resident in a locality is their odd cry at night, for their pellets are indistinguishable from those of the Screech Owl and their habits are very similar. Hear that odd cry on an autumn evening and you will never forget it; nor can it be confused with any other sound in nature.

The cry of the Saw-Whet, as the name implies, is like the sound of a saw being filed, but nowadays few people know what filing a saw sounds like. The next best description I can think of is that the cry resembles a long thin whe-e-e-e-p growing thicker and louder at the end. Its timbre is part way between a whistle and a shriek. The cry is repeated once or twice a minute, but it is a much

more cautious and wary performance than the Screech Owl's!

The Saw-Whet haunts the deep woods and utilizes high-up woodpecker holes as its roost and nest. One is most likely to find it as a by-product of the search for Screech Owls.

A Trio of Orchids

"One never says Scylla without thinking Charybdis; one does not see Arethusa without thinking Pogonia." I quote a clever orchid-hunting friend. Can the nirvana-breathing odor of the one be inhaled without recalling the companion odor of the other? Here are scents almost too fine for human nostrils—fit rather for fairies, bees and humming birds. If commerce *could* distill the fragrance of Arethusa's breath, this orchid would become first fabulous, then famous—then extinct. Skeptics at last might be piqued into seeking, even to the Antipodes, for proof of its existence. Pogonia would bask in reflected glory, for its aura, because fainter, is even more ineffable.

As in scent, these two are associated also in locale, range, color and time of flowering. And with them is a third, Calopogon, which to man is scentless. "They would blush still deeper if they knew what names man had given them," wrote Thoreau. I do not concur. To me even their names are poetry. Their loveliness has moved naturalists to rhapsody since nature-study began: doubtless

they have enraptured many beholders from Ontario Province to the Carolinas.

Near the east end of Lake Ontario there is a saturated sphagnum bog where the writer once saw a thrilling vision of seventy acres of Pogonias and Arethusas, so closely crowded as to give the effect of a rosy glow over large parts of the wide area. There being almost no leafage to these orchids, they are, as Thoreau has said, "all flower"; a characteristic which enables them to show their dainty tints to best advantage.

First locate your bog! Or, it may be, a low wet meadow, bitter with moss to inform the farmer how sour the land is. For it is from such sourness that nature's finest perfume is drawn! Then, during June or July, you *may* find this trio together. Or you may not find any of them, for they are localized exasperatingly. But because they are pearls of great price and as precious as rubies to rajahs, they are well worth the seeking. Years may go by in your search—yet a single trip may suffice.

The moment one ventures a word about the colors of these orchids, he is lost! Normal persons, one might assume, when looking at a given object, could readily name its color; but botanists and nature-essayists have presented us a diversity of

confusing epithets. Pogonia (the Snake Mouth Orchid) may be waxen-pink, rose-pink, peach-blossom red, crimson-pink, pale pink, or just pale-rose pink, according to the authority consulted. Arethusa (surnamed the Beautiful) is either magenta-crimson, crystalline-purple, rose-purple, bright purple-pink or as Thoreau called it, crystalline-purple. Calopogon (the Grass Pink) is readily (?) identified by rose-and-pink purple, magenta-pink, or purple-pink, with Thoreau describing it as pink-purple. Now, what is one to do with an assorted jumble like that? Why, call the color what you like, and identify each variety by its very different shape. Calopogon clusters three to ten blossoms on a single stalk; the other two bear solitary flowers.

The Hermit Sage of Concord, who loved these plants, speaks of the snaky odor of Pogonia; while both Schuyler Matthews and Miss Blanchan call it raspberry-scented. The two descriptions are hard to reconcile. And, speaking of Arethusa, Burroughs says that it smells like sweet violets. Actually, no comparison, no analogy, exists! When one is standing among the tropic orchids at the famous Botanical Gardens in Buitenzorg, Java, or at Peradenaya, Ceylon, it is instantly apparent that the English language's stock of odorous adjectives was crys-

tallized long before tropical orchids were known to Britons. Such descriptions as "halfway betwixt sweetpea and lilac," or a smell "like the taste of a grape-fruit," are quite as hopeless comparisons as those applied to this American trio, or to others of their kin. Just what does an orange taste like? Just how does an orchid smell? These are things one cannot express in words any more than one soul can communicate its *feelings* to another!

Mud Wasps

Those little rounded chunks of mud you may find on the rafters of your attic, or plastered beneath the porch roof, are innocent-looking objects. Perhaps you have never noticed them or stopped to examine them closely. But they have a sharp bearing upon human affairs at times, for they are cradles of juvenile Mud Wasps—and grown-up Wasps have stings!—that is, the females do; and alas, when they are in flight, there is no distinguishing between the sexes!

Different species in the genus *Sceliphron*, the Mud Daubers or Mud Wasps, construct somewhat different larva cases, but they always work in adobe or concrete. Some species place their cells like the tubes of a pipes-of-Pan, side by side; others place them end-to-end; still others encase a group of them in a large outer chunk of mud. But all bear the family resemblance: there is no mistaking them.

For weeks, how mother Wasp will drudge at her two-fold labors! Alternately she gathers minute globules of wet mud from the road and flies up to her construction job. While at her busy

plastering, she utters the thin nasal whine that everyone has heard. Then, one case being done, she spends a day or so hunting and storing it with spiders. Having filled the larder for the future sustenance of her offspring, she lays her egg on the outermost spider, seals the end, and starts at once building another case. Ceaseless toil for weeks, and well worth watching! If a dry spell intervenes, she carries water from a stream or well out to some dusty place and mixes the mud she requires.

When dried, the structure she builds is so brittle that it can be easily crushed between the fingers or picked apart like the shell of a hard-boiled egg. On opening the cells toward the end of the summer, one may discover in each an elongated pellet, in shape and size closely similar to a ten-grain gelatine capsule such as druggists sell, but dark brown, and coated—not with sugar—but with delicate silk-like material. Within this is a limp, but live and fat, yellow grub—the larval form of the young wasp. This grub, to grow fat after hatching and to fashion its brown capsule, has feasted for some three weeks on the succulence of the score or so of the spiders which its all-wise mother had caught, stung into instant paralysis—but not to death!—and then bundled into that mud cradle. Within the capsule may be dozens of dismembered

spiders' legs, for the bodies only have been eaten. Later, inside the mud walls, the larva will turn into its pupal stage. The following spring it will gnaw its way out to daylight, a fully equipped adult wasp. The mud walls of the cell must be prepared and laid in such a way that air can filter into the midnight interior of the pellet—but just how this is done we do not know.

The mother will never see her ogre baby except, perhaps, as a full-grown wasp: how then does she know the needs of the egg she has laid in the dark cell? How can she know how to sting so unerringly into a spider's nervous system as to paralyze and yet not kill her prey? And how does she know that, as that master entomologist, Fabre,* further declares, she can determine by the *number* of spiders which she provides to a cell the sex of her offspring?

Marvels in mud! Much is hidden in the darkness of the cell, but much can be studied by patient watching of *Sceliphron's* hunting and daubing. But be not careless with her while she toils, else you may find yourself a dauber in mud, fashioning a poultice to dull your pain—for mud giveth and mud taketh away!

Along with the Carpenter Wasps, the Mason

* *The Wonders of Instinct.*

Wasps and the Digger Wasps, the Daubers make up most of the species of the Solitary Wasp group: the other part of the family are the Social Wasps that live in colonies like honey bees.

Not only is it the fact that only female bees and wasps sting; it is also more or less suggestive that, among this numerous order, the female appears to be by far the more important and hard-working sex. Indeed, when circumstances require it, she is able to produce young *parthenogenetically*, i.e., without her eggs being fertilized by the male. Surely, here is food for thought for feminists and philosophers, as well as for entomologists!

About Crows

Few things more intriguing can be brought back as booty from the May woods than a baby crow or two for rearing. Unlike the bear cub, who is funnier, and the juvenile skunk, who is more interesting to the neighbors, young crows are readily located. And the raising of them is simplicity itself. My children are very keen (as they put it) about tame crows, and try for a new one each season.

Volumes have been written about the crow. He is famous—yes, and infamous—to not a few of his biographers. In this he resembles Napoleon. He further resembles Napoleon in his complete self-reliance, his cosmopolitanism and his many-sidedness. The crow is our composite, our ideal bird. He is typical of the class *Aves*. Frequenting our average, or general environment and climate, he has adapted himself to the requirements of his surroundings in an all-around manner. He is of about a mean proportional size between the humming-bird and ostrich. He can fly enough, walk enough, wade enough and is wary enough, to survive in and conquer practically every locality in

America. His beak is long enough, strong enough, round enough, curved enough, so that little that is food defies his efforts at utilization. He can stand hot summers, wet springs, dry autumns and frigid winters. And experts, studying his economic status, have at length concluded that his virtues about balance his shortcomings.

One of his interesting habits, not universally known, is that of building dummy nests in fall and winter. Whether this is an amusement, an occupation against ennui, or a perverted instinct, or whether, as some sages opine, it is done only by superannuated birds, is yet an open question. But occasionally in February you may chance to see a pair of crows as busy over a peck of sticks in a tree crotch as if they really intended to make a finely upholstered and finished job of it—which they never do.

I recall also a summer nest built by a pair of tame crows in the heart of a large Northern city. It was over a paved street, perched high up in one of a row of soft maples; and when I saw it one of the proud architects was sitting—whether upon eggs or vain hopes I had no chance to learn.

JOHN

An owl is the crow's pet aversion. In daylight should they discover one, crows pour out such billingsgate upon his luckless head that the exhibition

reveals to what vulgar depths bird nature can fall. They hang about in squads tormenting, scolding, pitching at the silent owl and then retreating, never ceasing their aspersions and denunciations—but they always act in concert, never alone. At night the rôle of pursuer is changed: the grim, silent owl makes little return by way of noise; but the effectiveness of his retaliation is most complete—as crows are aware. Hunters and exasperated farmers use this crow trait to the bird's undoing. A stuffed owl, mounted upon a high pole in a field, will, in a day's time bring all the black gangsters of the locality into shotgun range.

A study of the crow is a liberal education in ornithology: he is a cross-section of birddom; the highest common divisor of all avian quantities.

Depending somewhat on the earliness of the season, which in April may cause many upsets in the plans of feathered nesters, the black squatters usually start laying their beautiful green and brown eggs in late March in a Pennsylvania latitude, and throughout April along the Canadian border. One searching for crows' nests should remember that they will rarely revamp an old nest: an occupied one usually has a freshly stacked and neatly piled appearance that should catch the attention. Many an old hand at the sport, however,

has climbed forty or fifty feet into a hemlock, a beech, or a maple, only to find a platform thatched over and made into a Red Squirrel's nursery full of young, or else to discover a weathered ruin of yesteryear. Madam Corvus will not sit closely if the eggs are fresh, but later it may require sharp pounding on the tree trunk to dislodge her—though anyone below can see with half an eye her tell-tail projecting over the nest-rim!

Having located the nest, you should postpone the visit of abduction to a time when from the woods all roundabout can be heard the feeble cawing of black-feathered nestlings. Later than June 1st, it is wise not to delay the felony. By this time, although they may not yet have tried, the youngsters will often be able to flutter and scramble from the nest while one is ascending. Even very young, half-fledged infants may be taken and can be successfully raised but, until the feathers get a good start, they are most disreputable looking objects. At all ages they will swallow practically anything offered them: bread-and-milk fed with a spoon, angleworms, chopped meat, insects, fruit, fish, frogs, cheese; anything—and lots of it. A wide-open beak and hair-trigger throat mechanism make feeding easy. They will call for their meals when hungry and will follow members

of the family about, hopping and cawing, with quivering wings; but they will not learn to *pick up* food offered them until better muscular coördination and the technique of the trainer finally teaches them to do so. After a week or less of domesticity they will cannily keep away out of reach of Pussy and Towser, if unfriendly; and nothing will induce them to flee the premises. No need for cages or shelter; once they can fly a little, they will look out for themselves. A tame crow is so teachable, so clever, so mischievous that, if he decides to go South with most of his kind in the autumn—well, you will miss him. And if he decides to stay over with you—well, you will probably wish he had gone!

Discovering a Spadefoot Toad

No one could have heard that sound again and again without being curious about it. A gentle April shower was falling, my chamber window was open, admitting, now and then, a breeze laden with the rich, stirring smells of a spring night. I leaned out into the wet darkness, looked down into the millpond below—and listened.

Every few seconds a squealing, buzzing grunt came up from below. The brook, whose main current slipped along through the opposite side of the pond, was noisily carrying off a freshet from the hills. In spite of the disturbance it made, the peculiar sound rose clearly above it. I had never heard anything at all like it. The common toad drones out a thick whistle with a hum woven into it. It was too early for mating toads. No frog note is other than a peep or a croak. This call was a loud, emphatic, despairing sort of bleat. A quick process of elimination: it must be a Spadefoot Toad!

Again and again it quavered through the night. I put on my boots, took a flashlight and went out. Guided by its reiterated cry, I easily located my

quarry. The spotlight hardly checked its excited calling. As it floated in the shallow water, its throat swelled to a ball, its mouth opened, the noise emerged, the throat-sac collapsed. Then the whole operation was repeated. So pronounced were the buoyancy effects of the filling and emptying of the air-sac, that the little body bobbed up and down in the water as if dangled from an unseen string.

There seemed to be no other of Spadefoot's kin in the neighborhood so, after several clutches, I secured him and took him inside to the light. The identification was complete: a skin nearly smooth like a frog's; large bulging eye-knobs projecting above the head; big eyes therein, with brilliant golden irises cut squarely in two by *vertical* black pupils. This latter character alone established its identity beyond question. I had captured the strangest and least known of all batrachians east of Father Mississippi, the Hermit Spadefoot; least known, not so much on account of its rarity as because of its remarkable habits.

Next morning I took Spadefoot out of the pail of mud in which I had caged him for the night and carried him outdoors. He played dead in my hands. He made no attempt to hop, but no sooner was he placed on the soft ground than his back feet

began shuffling vigorously. In less than twenty seconds he was half out of sight. Thirty seconds, and he had vanished backward into the hole he had dug. Aptly named, Spadefoot!

Calling to a city-dwelling friend, who was spending the week-end at my home, to come out, I disinterred my shy plaything and, as my friend approached, dropped it at his feet.

"See *that?*" I asked, wondering if he would realize what boon chance had granted him.

"Um, why, it's only a *frog,*" he began.

"Whoa, stand still, likewise back-up!" I roared indignantly. "Look at that thing again!"

"Oh, ah, yes . . . it's a *toad,* isn't it? . . . What about it?"

"About it? Why, man, you are looking at a *Spadefoot Toad!*"

He essayed facetiousness. "Pleased to make your acquaintance, Mr. Spadefoot." I checked him. "You, my motor-dodging friend, have become to-day one of the half-score men of this Commonwealth of Pennsylvania who have *seen* a Spadefoot Toad!"

"By George, is that so! Tell me about them. Are they as rare as that?"

"Curiously enough, they're not so very rare, so say the sages; about as rare, I suppose, as eyes

belonging to men who know when and what to look for when they pass by them. . . . Take your stick and tap his snout. Watch him dig out of sight. . . . He's gone already! That's why he is called Spadefoot." Noticing that he seemed to be waiting for more, I launched forth:

"The proverbial Seventeen Year Locust has nothing on old Spadefoot for hibernation. Hibernating is the easiest thing he does. His book name is the Hermit Spadefoot, in token of his extraordinary aloofness from mundane affairs. No creature seems to take less pleasure in activity, sunshine, warmth, air, food, companionship, reproduction—in life—than he does."

"What do you mean, 'pleasure in life'?" he interrupted.

Then I proceeded to relate all I knew about *Scaphiopus holbrooki.*

"Well, most of his lowly life he stays underground, only feeding a few weeks on summer nights at the mouth of his burrow. After that, he is said to withdraw deep into the silences. A case has been reported of his having been dug up more than three feet below the surface from a spot which showed no exit whatever! At irregular intervals —one year, five years, three—he languidly disinters himself, earlier in spring than usual, stretches

himself, and concludes he will have a night or two in the nearest pond before his scant allowance of nocturnal hunting ends and he must turn in again." (I wondered how long my guest would listen.)

"Go on, doc," he said.

"It seems that this hegira to the pond is in response to a mysterious signal, for it is claimed that a number of frogs in the same vicinity start for the same pond on a given night, meet in the water for two, rarely three, evenings of sex discussion; and then, leaving a few thousand luckless eggs, go back to the earth, dig little subsoil pockets and endure a few weeks of necessary eating. Then they again burrow for a long, satisfying, undisturbed rest, and the things of the world concern them not." (I saw that my companion's interest was now fully aroused.)

"Let's dig him out!" he cried, and forthwith he did. "Why, he doesn't look at all warty like an ordinary toad, come to look at him. What goggle eyes! Look, bright, gleaming yellow!"

I called attention to his vertical pupils, like those of the night-prowling cat and owl. For, although the common toad prefers the dusk and dark to sunlight, this retiring cousin of his simply will not face daylight at all.

We picked him up. His capable hind feet bore

on the outside of the horny palm a strong curved spur, the toe-nails being stiff and heavy to match. Whenever we put him down, he dug in like a soldier under fire. At last, to start on a morning walk, we left Spadefoot. Above his burrow, I was moved to deliver myself of this fiat, ukase or ultimatum: "As for me, I keep vigil to-night beside yonder Spadefoot rendezvous, to see what we shall see!" My city friend caught my hand in solemn fealty.

But, as a matter of fact, no Spadefoot, not even our own, turned up that night of our vigil—and it was three years before I heard one again.

Although these odd troglodytes have been reported during the past fifty years as having been observed all the way from Florida to the Lakes, little is accurately known of their terrestrial habits! Fine game to hawk at, for tyros and scientists as well!

The Ant Lion at Bay

Almost everywhere that dry sand exists, or deep dusty soil lies open to the sun, the Ant Lion can be found. But because it is small and goes about its business in an unobtrusive way, it is usually overlooked.

Little conical pits in the sand, whose tops measure an inch to two inches across, are its lair. If the searcher approaches carelessly, he may glimpse a quick flicker in the bottom of the pit but, unless he digs deeply and at once, this is all he will see. But if he spies cautiously upon these little holes, treading softly, he may observe a tiny pair of long mandibles projecting from a beetle-like head. The remainder of the body of this insect-leo always remains under cover.

There the Ant Lion lies in wait until a passing ant or other small insect chances to overstep the edge of his treacherous trap. Then down the luckless one will slide. The lion, as soon as his prey is within reach, seizes firm hold of it with his toothed mandibles, and proceeds to devour his catch. Having finished the soft parts, he throws the remains, with a flick of his head, clear out of the pit, and

settles himself for another wait. With diligence you can watch the whole operation. You may even bring it into your laboratory! And perhaps once in a blue moon you may happen to see an Ant Lion's pit under construction. The insect rapidly tosses the excavated material aside with his powerful neck. Down it works until the hole is deep enough—and that is the extent of the process. While watching the struggles of a trapped ant to climb out of its pit, the lion, it is said, sometimes flips up particles of sand to add to the landslide and render its victim's escape more difficult.

This voracious little beast is a larval form of a lace-winged insect (order, *Neuroptera:* family, *Myrmeleonidæ*) which looks like a diminutive dragon fly. Having digested sufficient prey during its period in the lion-pit, it makes itself a silk cocoon for its pupal stage, lies quietly buried during the winter, and attains its majority the following spring. Its strange adaptation for securing food is one of the many marvels for which insects are so noted in the long catalog of their traits.

Morels

If the out-of-doors epicure wished to pass along to a friend less sophisticated in the ways of the woods, a certain one of his most cherished secrets, a knowledge of morels, he might well have some hesitancy how to put it into words. He could not properly speak of them as mushrooms; the word is misleading. Morels do not look like mushrooms. To designate them as a kind of fungus would be to call up unpalatable connotations; for fungus is likely to be reminiscent of mouldering decay and dank corruption. So he would most likely begin vaguely: "Well, morels are . . . morels. You have to look for morels."

Morels *are* fungi, but they are gathered in the gay spring sunshine, from the rich orchard or meadow sod, and at a time of the year when almost no other fungus is growing. If milk-fed poultry and corn-fed bacon are the gourmet's choice because there is actually something in the feeding; then the fact that it is spring-fed accounts for the morel's unrivaled superiority among fungi. I do not except the truffle of France and Italy, nor the Giant Puffball of America at its cooking prime.

In late April or in May there may be found by the well-coached seeker a curious buff- or cream-colored object, surmounted by a honeycombed, pitted, netted, cap or spike. It will be hollow, and shaped not unlike an inverted pine cone. It will be upheld upon a round hollow stem about an inch in diameter. Its height may reach six inches but, in certain soils, it may be only an inch high. The surface of this bulbous pine cone resembles tripe, so that if one knows what tripe looks like, he will know what to look for. Where shall he look? Either in heavy grassgrown, ancient orchards, or in open thickets with a rich soil-floor and a plant-carpeted ground. And where once you have located them, go every year; for their distribution is sharply localized. Similar situations close by may be utterly without them. You take your chances—there are no handicap starters. Where morels were, there they will be—perhaps. Where they do not grow, they simply do not. The more miles, the more morels—that is all. But having sought knowledge about morels, and laboriously found them out, you will have in the eating of them a great reward.

Before the searcher sets out upon the quest of this Golden Fleece, he should con the elements of

"What a Well-Versed Mushroomer Should Know." This much of preparation he owes both to his prospective standing as a naturalist, and to his alimentary tract!

Are mushrooms fungi? Are fungi plants?

There are, to be exact, but three fundamental types of life. In the beginning (long before Adam) was the sun—and the sun is the god of life. Probably there could be no life upon the planet until some magic mechanism of nature enabled the elemental jelly to transform sunlight into food, power into life. Chlorophyll, the green-coloring matter in the leaves of modern plants, is such a mechanism—developed through millennial eras until it has become even more magic.

The first life—plant life—was thus enabled to manufacture its own subsistence. Later, much later, developed the second type, animal life, which does not have this capacity. Animals must eat plants (or eat other animals who do) and hence can be thought of as parasitic or secondary life-forms. Finally, in the vegetable or plant world, certain groups, *saprophytes*, evolved the ability to live on the juices of others. Ultimately they lost their chlorophyll magic and green color, and became the third type of life, the fungi-bacteria-yeast

type, which are neither animals nor true self-supporting plants. They produce no seeds, but reproduce through spores.

Curiously enough, the fungoid, saprophytic property has also been acquired by many seed-bearing green-plant families. The Indian Pipe and the Cancer Root are such parasites; not fungi, but black sheep degenerates, quite accidental exceptions of relatively recent birth.

Fungi care nothing for sunlight: they only "take the air" to scatter their spores. The flower of the fungus is all we ever notice. Bread mold, puffballs, coral and field mushrooms and, on dead tree trunks, the oyster mushroom, the beefsteak—and the shelf-fungus—all have root masses of sucking-threads, *mycelium*, of wide extent, which ramify deep into the food substance of the dead or living host they thrive on, and only throw up into daylight their reproductive mechanisms. These parts, some of which are edible, are the nearest to a flower that the flowerless and spore-producing fungi possess. It is a puzzling thing that mushrooms and puffballs can grow in a single night (or nearly so) as no true vegetable could do, but it is due to the fact that they have an ample food supply stored below the surface ready for action. Their rapid growth may be aptly compared with

the quick budding and blooming of a plant *flower*. Early spring bulbs, for instance, burst into sudden blossom when the reserve food supply in the bulb is activated by warmth and dampness and before their leaves appear. Also such trees as Red Maple and Elm have last summer's sugar food stored in the roots to give an overnight bursting power to the flowers a month before their green leaves appear and function.

Assume that—like the tamed tiger cub who goes wild once it has tasted fresh blood—a family has tasted morels: then, when week-ends in mid-spring come around again, the dietary schemes of even the smoothest-running household are likely to be upset. Divers members of the family are apt to appear in the kitchen at all hours, bearing anywhere from two to twenty morels, and remorselessly demanding—in the face of all maturing preparations and menu forecasts—that their booty be served at the next sitting. It is domestically demoralizing—but what can be done about it! Once a person has partaken of *Morchella esculenta*, he is thenceforth the cook's despair in morel season. They are with us but a fortnight or so: they demand right-of-way—and get it.

Even the Olympian gods must have become hopelessly tired of ambrosia and nectar served

daily so we need not regret that morels pass with May, for other succulent fungi persist around the summer and autumn clock. On page 146 something of the toadstool-mushroom controversy is threshed out for your stomach's sake.

Cocooning and What Comes of It

It is hard to see how the stern laws of Newtonian physics can apply to moths in their pupation processes. It is even harder to imagine how their deferred embryo-life accomplishes the remarkable structural changes that take place. To go into the pupal stage most caterpillars shrink within a few hours to half or third their former size and become mummies; upon emerging, weeks or months later, they expand to even larger dimensions than before, their wings, abdomens, legs, bursting with juicy vitality. From whence does it all come, since the caterpillar ceases eating before it encases itself, and cannot come into contact with any moisture worth mentioning thereafter? How baffling!

A by-product of country walks in autumn, after the leaves have fallen, may be a collection of cocoons made by our commoner large moths. Whoever takes a stroll with eyes awake to them, will usually be rewarded with something in the way of cocoons to bring home. And winter is an even better time to find them.

Although what man has named silk is employed for various purposes by several insect orders (and

by the web-spinning spiders, too), the word cocoon properly designates only the temporary sarcophagus spun by a few of the moths. The full-fed caterpillar, feeling adolescence coming on, makes for itself, with the prescience of Noah, a damp- and wind-proof casket for its winter hermitage. It is the cocoons of the Giant Silkworm family, showiest of moths, which are most commonly found by the amateur. Next most numerous are the Hawk moths (or Sphinx moths). You may come upon an alder, sassafras or spicebush, or a sapling ash, which has a dozen—even fifty—of these oval capsules dangling from twig-tips. Count it lucky if you find but one! If securely hung by a tough silken cord, these will be cocoons of Promethia—the smaller ones male, the larger female. The adult sexes are so strikingly different as often to be mistaken for different species.

By accident—for accident must play a large part in finding all but three species—Promethia, Cecropia and Bagworm—you may discover lying on the ground among the dead leaves of the woods certain much larger oval pellets, each wrapped in the remnants of the leaf in which it was spun aloft. Such will have been fashioned by the splendid Luna or by Polyphemus. Cynthia, may also be discovered, but has a fuzzier cocoon. The three co-

coons are difficult to identify except that Polyphemus makes the flimsiest capsule.

The winter dwelling of the smaller Io, however, rarely falls from its site; it is to be looked for amidst low shrubbery and bushy thickets. It too is thin and oval, resembling Cynthia's.

Cecropia, largest of the giants, forms a distinctive cocoon: it is larger, it is attached to a twig *along its whole length*, and it is not blunt at either end. Its inhabitant, not having been particular in diet, the cocoon may be spun on almost any tree.

These, then, are the common Giant Silkworms —Cecropia, Cynthia, Io, Polyphemus, Promethia and Luna. None of them in the winged form possesses more than rudiments of a mouth or stomach and they have but one mission, reproduction. Colored to shame the lilies of the field, they have toiled and spun, but no one has ever worn a garment woven from their silk. It is only the wholly domesticated *Bombyx mori* of Asia (not known to exist in the wild state) whose cocoons yield the silk of commerce.

There is to be found in certain localities throughout the East the Bagworm's structure, hanging from a thread like Promethia's, usually upon cedars and hemlocks. If a caddis-worm tube from the pond bottom is familiar to you, you will

instantly recognize these Bagworm cases. Bits of leaves, straws, cedar needles, are woven in with the insect's silk strands, so that the whole looks like a little bag of trash—the female's an inch or more in length, the male's smaller. An unusual life history is enacted by them, among the features of which is the peculiar fact that the female adult is wingless and *never emerges at all*, but is fertilized in its case, deposits its eggs therein, and dies. But the little male will come out, and perhaps under your very eyes. Many of the Sphinxes or Hawk moths burrow into the earth a few inches, and go into the pupal stage without much of any cocoon except their own hardened epidermis. Only digging will turn these out, unless you have gathered some of the caterpillars and had them hibernate for you. The pupæ are unmistakable objects of many sizes and shapes, out of which may emerge almost anything surprising in the way of fancifully colored moths. (A few Hawk moths do not burrow but roll up in the trash of the ground.)

As there were snakes even in Eden, so do these lovely creatures of Paradise have their enemies: many a cocoon will be found punctured by a tiny hole, through which certain of the Ichneumon flies have thrust their needle-like ovipositors and have

laid eggs on the inmate's body. Emerging from these eggs, the parasites devour their host for their own greater glory. Such pierced cocoons are not worth collecting.

All unstung cocoons when brought home have more than an even chance of hatching under domestic inspection. The soil-burrowers must be placed in earth kept slightly dampened; the others in fresh outdoor air, not in heated rooms, although it is said that by thoroughly moistening them every few days, if kept in living rooms, they can be preserved through the winter. In warmed quarters, however, the inmates will often come forth in midwinter, only partly metamorphosed, with pitifully unformed wings. Nevertheless, the emergence of the moths will most likely escape your eye unless the cocoons are hung where you can hear their tiny efforts within. Few experiences are more thrilling to observe than a moth's resurrection. Some cut their way from the tomb with tiny head appendages; others are known to secrete a liquid from the mouth which softens the imprisoning threads. After emerging, they sometimes cling quivering on the cocoon for hours as the magic chemical processes within them fill them full of the liquids of life. Wings grow before your gaze, abdomens fill out, antennæ elongate and stiffen—and lo, sex

becomes a reality, nay a necessity, a cosmic urge toward which eternity has travailed to this hour.

Now, if you put the female moth in a screened porch or box, more wonders ensue! Males of nearly all moths have antennæ larger, longer and more elaborate than their mates. This is because in the Great Adventure of mothhood, it is the male who must be equipped to search out his mate against all the obstacles of environment. The female waits, and neither eats nor sleeps until her eggs are laid: then she dies, her mission done. The function of the male antennæ is undoubtedly that of smell, that being the nearest analogy we can make. But the nicety of this sense transcends human, and even bloodhound, nostrils. Cover the female under glass, and no males will be attracted to her; but cover her only with screening, and she will broadcast an odor which is startling in result.

In one evening that ineffable lure will attract males from miles around. Although you may swear that not a trio of Polyphemuses or Lunas inhabit the whole township, morning will reveal that they have come in twos, fours, dozens, scores, perhaps, to the rendezvous. In the limitless Adirondack wilderness where Cecropias are passing scarce and shrubbery and trees very dense, I have had four

velvety beauties on the outside of a screen within three hours after a female had been placed within. On June 15, 1918, a female Polyphemus, splendid in her yellow and brown and blue, just emerged from her cocoon that afternoon, clung in the top corner of our screened porch in southern New York. Next morning we found one living male outside, opposite our decoy, and, upon the lawn below, the scattered remnants of fourteen sets of wings! Apparently no sooner had an enticed wanderer approached this Circe than some dragon of the air—bat, owl, or whippoorwill—descended upon the hapless one, sheared wings from body, and engulfed him. The last intrepid comer—always there must be a last and successful one, else moths must perish from the earth—owed his brief respite from extinction to the law of averages, specifically to the satiety of whatever creature had devoured the others. At another time, after I had brought home Lady Luna at nightfall from a cypress swamp in Florida, eight fluttering, eager Luna males came to our porch, fairly rustling the air with the pale green sails of their flotilla of ghostly galleons in search of the Haven of Love.

What I have written above, limited by space and weakened by generalities, but feebly suggests

the fascination of cocooning. "Sugaring" for moths, luring the males, collecting specimens for permanent mounting, as well as cocooning itself—all of which can be easily studied-up and practiced—afford one of the most peculiarly satisfying of hobbies. There are many unsolved mysteries about moths: Can they see colors at night? Else why are so many night-flying moths so brilliantly and complexly colored? If they are connoisseurs of color, why are most night-blooming flowers which depend upon moths for cross-fertilization, white? Why is it, since they are so attracted by light, that they are not similarly lured literally to reach for the moon and to start off toward that unreachable light? Further, for creatures so gifted in scent detection, why are such gleaming white and creamy flowers evolved for night-blooming, since an odor would have served as well? And lastly, there is the puzzle mentioned in the first paragraph of this chapter—the disappearance of matter in the pupal stage and its reappearance when the cocoon mummy answers to the trumpet of the Last Judgment and becomes an angel of light!

The Seven Sounds

You and I whose lot it may be not to conduct our own affairs any too well, but who cannot keep from prying into the affairs of "the bee, the bird, the bat and the badger," we who peep and botanize about over this millennial grave of our Mother Humus, *do* have odd moments come to us when we are sympathetic with that jaded gourmet who longed "Oh, for a new animal!" But these are, thank God, only odd moments. For an all-around, first-hand familiarity with out-of-doors demonstrates how reserved old Mater Matrix is, how reticent, how little to be drawn out even by her most intimate confidants. First-hand familiarity, I say, because we may grow bored with conning books and books about Nature, but not with Nature herself. And I don't so much mean that, in following puzzling trails back to Camp Explanation, we so often discover that truth ends in the underbrush or disappears into a knothole way over our heads. I refer rather to the infinity of unnoted habits and characteristics that crop out everywhere, from every plant and animal we study, and to the common beings at hand whose intimate doings we have

not thought to notice—we shall never get to the end of them! To travel to Asia, to Africa, to go away from the native environment we know best—that is merely a baffled surrender, an escape as the Freudians say. What we see there cannot be the laboratory that our lifelong surroundings afford. To go Big Game Hunting is to yield to a sadistic blood-lust which wrecks expression where it can be least opposed; a nature *lover* will as soon do that as go out shooting at a herd of Holsteins! There is no need to go abroad, nor to seek nepenthe in jazz, or surcease in bridge; for Nature's frontiers have not all gone, though pioneer America's have. What though there be no new animals, plants, or bugs to be discovered and turned over to grim scientists for the holy rites of classification? We yet may stand who will, and gaze in wild surmise over many Pacifics. There are fields to which we may go for sights and sounds that thrill. There is zest still in the anagram called life!

For example, there are the Seven Sounds. If one has not heard the Seven Sounds and each of them, he has yet to climb the final peaks of Darien! What are the Seven? Do not imagine that by cochlea and tympanum laid close over this cold type you can hear them. Here we can only extend a vicarious invitation, not lend vicarious ears!

Sound the First? . . . Science names him The American Bittern, but country folk say Thunder Pump, Bog Bull, Stake Driver and, much less aptly, Crane, Mud Hen, Indian Hen, and Brown Heron. Mud Hen seems to be the favorite, which is odd, for a long neck and a pair of wading legs are as unhenlike as possible. He is neither chick, crane, nor good red heron; but of a different stripe, a Bittern: the Bittern which has been a sort of symbol of desolation to Englishmen reading their own pessimism into things:—

> "Where now is Britain? . . .
> Even as the savage sits upon the stone
> That marks where stood her capital, and hears
> The bittern booming in the weeds, he shrinks
> From the dismaying solitude."

And Shelley speaks of a time "when London shall be a habitation of bitterns." How anyone but a realtor can regard a marsh as a desolate place, is beyond me. Certainly more vitality is packed into an acre of marsh than into an acre of brick-and-cement New York!

I have noticed that this demon of meadow-swale and swamp puts in a northern appearance—in New England—during the first week of May. From then on until haying begins, the voice of the Bittern is heard in the land. Call it a song if you

like: I cannot. Though, of course, that, in strictness, is what it is. "Chunk-a-la-plunk" the libretto would phrase it, repeated half a dozen times with a bullfroggy timbre, and with a strong accent—not to say a choke—like a released vacuum on the plunk. Sometimes the sound rolls across a wide expanse of water or meadow, much of its fluidity absorbed en route, so that for all the world it seems as if a heavy piling were being driven in by alternate strokes of huge mallets. Tradition held for many years that the Bittern emitted this roaring croak with bill submerged. Then, as so many other traditions have been shattered of late by substituting observation for hearsay, ornithologists here and there, shod with gumshoes, reported to the contrary. One day, nine or ten years ago, the luck befell me to worm my way successfully over a knoll above Thornton's Swamp and observe a Bittern in full cry. The sunset light struck squarely upon his golden breast streaked with brown—and lo, instead of pointing his yellow beak downward, my entertainer elevated it to the zenith, and pumped away furiously as if to get a whole bodyful of air up and out through his clenched bill. As later search revealed, the female had been enjoying his serenade in a nest built on a grass tussock thirty rods away. Under her was a

clutch of five of the oddest-colored eggs. Oliver Davie writes it down as "Isabella" color. The Isabella adjective—of most amusing origin!—does *not* justify applying this phrase to these shells, for they certainly do not resemble the color of that "princess's shift worn for four years." Had olive-drab been invented in Davie's day, he would undoubtedly have used it, for that is just the color a bittern's egg is. So far as I know that shade is unique, although the English Pheasant attempts to copy it. But nothing in feathers or clothes can copy the Bittern's song.

Although experiments are said to have proved that shrill sounds carry farther than deep ones, there are certain natural sounds which seem to belie this conclusion. The bellow of bullfrog, the roaring of tigers—such as I have heard near Jaipur, India, from newly caged captives—the loon's wild howl, the heavy honking of geese, the thunder of surf, the chunk-a-la-plunking of the Bittern: all these carry as if megaphoned.

The Second Sound comes from the woods—the drumming of the Grouse. This was also for generations a subject for controversy, perhaps because people did not have the spare time to investigate it and were satisfied to have a ready-made fable

all wrapped-up to take home. It is like no other of nature's sounds. Does the Grouse make it by beating an inflated chest with his wings? Or do the vibrating wings beat the air alone? This was the dispute. Futile, because a bit of stalking would have easily settled both fables, the method of the drumming of the Grouse and that of the cry of the Bittern. It does, however, require patience to observe the Ruffed Grouse booming his mating signal through the woods. "Thump . . . thump . . . thump . . . thump . . . thump, thump, br-r-r-r-r," growing diminuendo with each beat. Were it not that the skulking drummer has a few chosen spots to which he steals, and to which he comes tiptoeing back after a disturber has passed, the drumming Grouse would be seen even more rarely. Until, from the kitchen window a few springs ago, I saw one practicing on a stone wall behind the barn, I believed the process was truly a drumming, a beating against a hollow cavity. But now I can throw myself on the fanner's side. The thing was absurdly easy to determine once you could watch it. Cock Grouse goes in most vigorously for drumming in spring, since it is a bit of mating braggadocio but like the wing-beating of his not too far-removed cousin, the rooster, his drumming may be practiced at odd moments all through the year.

The rooster's performance, however, is little more than a vestigial gesture, like the wing exercises of domestic ducks and geese; for they have sold their birthright for a mess of corn.

Sound the Third . . . Do you believe in Ventriloquism? In the pre-gasoline days, no Lyceum Bureau up our way would have presumed to approach local committees for bookings without offering at least one Ventriloquist. Alas—and literally—where is his voice coming from now! With his once equally popular brothers, the Phrenologist and the Hypnotist, he has entirely passed out of hinterland lecture courses. We know that people there are who doubt evolution, bacteria, curve pitching, and the changeability of human nature. The world is wide—or used to be—with room for multitudes of human atoms to whirl blindly about without ever having their eyelids knocked open by collisions with facts. So, with such as doubt ventriloquism, I would like to take a few walks in the country. I would like to be with them when they hear the wild Mourning Dove and the Barred Owl. There are others, but a short course with these should convince the most skeptical that ventriloquism really exists. No doubt it serves two or three life-preserving purposes. When one of the

big owls begins hooting in a tricky manner, he probably does so to deceive his prey as to his proximity and send it rustling to cover, and so to self-betrayal. Birds which are hunted rather than hunters need this device to signal others without betraying themselves to enemies. Other apparent cases of bird ventriloquism may be accidental misinterpretations of human ears. Most bat language we cannot hear at all: it is not intended for "our large furry ears," but for sense organs which we do not possess. Blindfolded bats, it is said, avoid hitting threads stretched in jackstraw fashion all about the darkened room, by detecting the infinitesimal echo sent back as their whirring wings approach a thread. If this be true, why should we wonder that human ears are not fully attuned to what birds say? Some calls, like those of Chat, Mockingbird and Thrasher, would seem impossible to explain as voice-placing.

Fluted through the slender bill of the Upland Plover (Bartram's Sandpiper) the trick is at its best. The bird whose note you hear may be hovering high over your head, following your every move near its nest, yet you vainly search the distant horizon to detect it. Skeptics as to bird ventriloquism should make the acquaintance of this eerie, reticent Plover, a non-conformist shore-bird,

who has foresworn the moist riparian religion of his kind. He has lifted up his eyes unto the hills —for food—and has stayed there to found his house and raise his family. He is of a hermit disposition, sufficient unto himself and household. Unlike other sandpipers, he does not frequent water, but lives on insects much as does the ever-wanderlusting farm turkey. His coming, early in May, overflows the cup of spring. If you would make a pilgrimage to his haunts, go to hear him just when the blue, white, and yellow violets are thickest in the woods. Pastures—but not pastures new—he loves, and there he summers, running among the stones and mullein stalks, perching stiffly on a fencepost, or flying overhead with a hovering flight and a quivering mellow whistle. I know one old pasture on a hillside to which I can steal through a patch of evergreens and observe through a zigzag rail-fence. At length, a sound comes. From far, far off. From east? west? Whence? A spell enwraps me. I seem to be listening to disembodied sound. Is it the shimmering heat waves hypnotizing me—or is there in reality a pulsation under my feet? Ah, there it is! The bosom of the earth rises, falls, rises, falls, as calmly, placidly as a sleeping woman's breast. The curious illusion vanishes: it is only a sound after

all! . . . That sound is the most ventriloquistic in the bird world. While listening to it your sense of distance is bewitched. The ground, uneasy with the abundance of summer below that must soon pour out, heaves and sways with its rhythm. A liquid whistle, crescendo-diminuendo, a two-noted cry comes down to you—heard sometimes when the bird is too high to be seen at all—deliberate, long-drawnout—a sigh that begins gently, strengthens, dies away. . . . This is the third of the Seven Sounds.

It is not hard to guess why the Loon evolved his peculiar cry; it must carry far, across thick timberland, from lake to lake, from valley to valley. It must be heard above the noise of winds and white-capped water. And because Loons rarely fly except at migrating time, it must overcome the handicap of rising always from water level to carry up and over natural barriers. It is, I think, the loudest cry of any North American bird. Well does the Loon, with its resonant howl and shudder-fetching laugh, merit the name. Most commonly the performance has three parts: a wolflike howl, blood-curdling laughter—some variations of which are like screams from an hysterical girl—and, at the end, a despairing, fading hallo-o-o. That is as

near to a description as I find possible. If forewarned, anyone spending his first night in the Big Woods can recognize it at once; if not, well, it can stir up a prickling along the spine and an uncomfortable feeling under the scalp. In the still forest that voice is as much a part of the solitude as are the mountains and the balsams.

On northering migrations I have often heard a Loon screaming along through the sky as he goes, although invisible in the clouds. One chill and drizzly April morning while we were reforesting one of the back pastures, we saw at different times six of the big stern-wheelers go over, though we would not have noticed any of them had not each come howling along to call our attention. They can hardly contain themselves as they go back to their northern haunts, especially on those heavy misty nights when so many geese are traveling, too. You hear them laughing crazily to themselves in breathless eager chuckles of glee at their homecoming. I suppose no other bird which makes such prodigious spring and fall flights, allows its wing muscles to become so flabby between migration. Possibly there is actual muscle weariness and pain in that "glee," and the bird is keeping up its grit by noise—as one sometimes hears an overloaded coolie on a Hong Kong street, his face

contorted by "the adrenalin scowl," chant himself along lest he drop in his tracks.

In May and June in the Adirondacks, Loons often stay up all night which means that sound human sleep in the vicinity must go over for a few nights also. Shrieking wild apprehensions, pregnant with intuitive calamity, they seek and seek and seek, through the livelong night for some comrade that is lost forever—a brother-ghoul they fear will not be found.

After despair, comes ecstasy. Sound The Fifth.

Wondering if anyone has said it before, I must call the eccentric Woodcock the nocturnal skylark. The phrase is not hyperbole. Night hath her skylarks no less than day; America no less than Europe. Even a gawky snipe like the Woodcock may be a lark when he pleases and be not miscast either.

A nocturnal skylark . . . It is a March evening, warm—as nature enthusiasts estimate warmth—perhaps there is a moon. A sparse thicket clothes the slope that forms the valley-side across our wavering brook. Two hundred yards from our chamber window begins the ancient and primeval secretiveness of a long-neglected scrubby pasture. Those six hundred feet are almost the span between

the Triassic and the modern Commuting Eras. A wailing Screech Owl implores twilight for a mate; the Hyla chorus from the woods is distant enough to sound

> "like a ghost of sleighbells
> In a mist of snow!"

The east is just blanching as if in fear of a premature dawn; a wisp of cloud there above the horizon silvers slowly into incandescence; and lo, the moon's full visage peers at dying sunset! Suddenly, we become aware of a queer sound being repeated every twenty seconds or so up there on the valley edge—much like fiddle-bowing upon a one-stringed cello. It is not unlike a wild duck's furtive guttural *zzzt, zzzt, zzzt,* when it senses some danger. Of a sudden the metronomic call quickens, then misses a stroke . . . The air is full of wing-whistling and twittering. Its source is no longer at the ground: the bird has started to fly. In a moment a chirping is interspersed with the rest, and there has begun a rise-and-fall rhythm of the whole. It becomes an ecstasy, growing more rapid in tempo, more insistent, the chirping predominant. The sound is spiral, whirling. . . . Ah, look there—the performer! A dark little body with swiftly beating wings circles round and round

between the stars, the moonbeams and us. Up he goes, and up. We lose him; almost we lose his silver ecstasy. As from "a poet hidden in a cloud of fire," down rains the fainter-growing jubilation. It seems still to be accumulating fervor as it becomes finer and fainter.

It has ceased! . . . We know—for a few times we have seen it happen—that night's skylark has suddenly folded his wings and dropped like a plummet to earth. *Zzzt, zzzt, zzzt,*—he is back again on the hill. The old, old story in Woodcock language has been told again. It is a Dionysian rhapsody. How inept to speak of "the Woodcock's evening *hymn!*" Emerson could only have used the phrase to make a rhyme for the last line of his quatrain: "And the sky hawk did wait for *him.*" Low-grade rhyming and lower musical appreciation, I call that verse.

What does such bird music signify? What is the cause behind it? To explain it as the outburst of mating desire is as inadequate in this case as it is in many others. Why, each spring, does this bird keep up his performance for over six weeks—into the latter part of May? By April first the egg-shells normally crack and the tiny family becomes instantly peripatetic. On many occasions I have seen him go into this flight when I was creeping

at night within ten feet of the spot from which he rose, and I have flushed him also in broad daylight from the same little area. Why have we never discovered any mate, nest or young roundabout though we have most diligently sought? Why does this hymning always center around that same forty-foot patch of mossy sod in the pasture hollow, where there is neither nest-site nor food, and a minimum of concealment? Is this a bachelor, unbalanced by thwarted love, who will never leave the trysting-place? Or is he infinitely sly about his love affairs? We are convinced that he does not migrate in winter, for we have seen his footprints in the snow along the brook. . . . Ah, Naturalist, know thine own backyard!

Sound the Sixth . . . To put the Yellow-breasted Chat calmly and candidly into print is scarcely possible. He is Himself, individual in the last degree; a thing like electricity, difficult to discuss except in terms of what it does. An acrobat, a comedian, a ventriloquist—a chat-erer. In whatever company, he is the life of the party. If you live within a half-mile of his home-site, you will know it. No other feathered creature impresses me as having any sense of the comic in its make-up; the Chat irresistibly does. If he is not a comedian,

why in the world all that aerial Charlestoning? Why flop by short wing-beats above his back, from one bush to another, squawking and cackling so self-consciously? Why execute a rapid series of somersaults in mid-air? Why undulate along in short swoops, tail wagging up and down, if not to show off?

In the shallow drawers of the classifying naturalist, the Chat is laid away with the Warblers —the largest in that group—though, being of much less exact mentality, I must always think of him as cousin to the Mockingbird. A versatile mimic, he is a bird whose repertoire is not limited by heredity. For, being a good listener, he picks up foreign languages easily, and sports a vocabulary conditioned by the pasture company he keeps. Like Mocker also he frequently revels all night as well as all day. What compelling and tireless demon plagues them? Though no one has come forward with a satisfying reason for bird-song, we may accept one which Keats unwittingly supplied in the final two lines of his "Grecian Urn".

> "Beauty is truth, truth beauty, that is all
> Ye know on earth, and all ye need to know."

It may very well be that there is no one cause, but that the reasons are as various as those which make people sing, steal—or go to Grand Opera.

If one is good at classification, let him specify the emotional drive behind, "C-r-r-r-r-r—whrr—that's it—chee—quack—quack, cluck, yit-yit-yit—now hit it—trr-r-r-r—when—caw—caw—cut, cut—tea-boy—whooo, who—mew, mew." This is Mr. Burrough's rendition of what might be called the Chat's song! Beyond this is a polyglot patois that defies the notebook.

The last Sound is eeriest of all, and surely rarest heard: the "winnowing" of Wilson's Snipe. Another night experience! Probably not a thousand people alive in these United States have heard it! Not that it is not *there*, but that no one *listens*. If you chance to be walking in the stillness of a country road at midnight, and the year is at mid-April, there may strike at your consciousness time after time, at length getting itself heard, a mysterious whirring whisper—half a whistle, half a moan—wavering off into silence. During my boyhood that strange sound used to send shivers down my spine. I could not place it. It was not the wind, nor any animal noise I knew. And what bird was it? That it might be a ghost in the air—I was not too old to think that! So baffling to place, so faint at its beginning, so fading into nothingness at the end:

"A sound so fine, there's nothing lives
'Twixt it and silence."

And then, one unforgettable April evening, I saw it all. A bird! My eye caught him for an instant near the moon then lost him again. Five minutes, and I saw him once more. Meanwhile, at irregular intervals, that wavering moan drifted down from the sky. By half an hour the ghost was laid forever, though, until I chanced to encounter the ghost-bird next season on the ground—before it started on its broomstick ride to the moon—I did not get the clew that it was a snipe. . . . This is the way of it: Shooting headlong among the stars at a terrific speed, his flight is suddenly checked by a short vertical fall—the fall is what you hear. Then he recovers, like a skillful aviator, and goes darting off again even before the sound reaches you. As he drops, the taut wing-feathers vibrate in some peculiar manner which gives the uncanny effect. These swift gyrations go on for an hour at a time, before he falls, exhausted, into a marshy spot where he is making a short stop-over on his trip to Hudson Bay. The Nighthawk does a similar nose-dive in making the booming buzz so familiar on summer evenings. But the latter is a tearing and unpleasant noise, while the winnowing of the snipe—ah, well . . . to hear

it you must stay out-doors a great deal after you have shed your winter ear-muffs! Especially is it a sound you have to *listen for* to hear, and it goes unnoticed by most of those over whose head it whirls. It is wing-music only, no song goes with it. Yet, after all, it must itself be singing.

They are seven. Yet seventy times seven moons may wax and wane ere one pair of ears shall hear them all and, hearing, grow wearied of the conquest.

Flying Squirrels

Along in April or early May, while you are walking through a piece of woods, if you notice a promising-looking hole high up on a dead tree and tap tentatively upon the trunk (and such inquisitive tapping is good nature-study technique always and everywhere!) then, once out of about four hundred and forty-two times, you may see one or more curious little heads pop out to peer down at you. You have found a family of Flying Squirrels! They are much commoner residents than you would guess—so shy and retiring!

You will notice that the little rascals above have unusually large eyes for squirrels and upon repeated tapping, you will be astonished at the number of inhabitants which will continue to emerge from that hole—sometimes there will be eight or nine. But you will be delighted by the wonderful lightness and grace of the jumping flights they will make to the near-by tree-trunks. Of course they alight at a lower level than that from which they jump, yet, by repeating the process, they are distributed in no time to the four compass-points and out of your range of observa-

tion. If, however, the young are very small and hesitant, you may catch them and examine their silky fur—excepting perhaps the Blue Fox of the north, their fur is the silkiest of all American mammals—and the little sails between their legs which they spread when they volplane. For these animals with their flattened tails and the loose skin along their sides, are not flyers but gliders.

The Flying Squirrels have a decided liking for deserted houses and summer homes. When the summer resident arrives after they have taken possession, nine times in ten he will mistake the midnight pattering of their feet for those of rats —and too often will act accordingly with traps, cats and poisons. Because they are wholly nocturnal, they are seldom seen. In the attic of my house a family of them has lived for at least five years, and only once have I caught sight of one. They are said to be readily caught alive in box- or wire-traps—but that I have never tried. Observing them in the woods is fun enough for anybody, without one's being so discourteous as to disturb the guests of one's own home!

Telling the Evergreens Apart

THE Conifers, or Evergreen Trees, form a most satisfactory group for a beginner in the study of trees to master. Their number is not confusing; nearly every section of the Allegheny and New England regions has a representative of each genus; and the general characteristics of each genus sets it apart from the others.

Strictly speaking, the designation of the order either as Conifers or as Evergreens is inexact. The Yews and the Junipers do not bear cones; nor do the Larches and the Southern Cypress remain evergreen but shed their leaves in the fall. Moreover, the Ginkgo (if it be allowed to remain in the order at all) bears neither cones, needles, nor winter leaves. However, these slight vagaries need not interfere with such identification of these trees as will enable anyone to refer to the various evergreens without calling them all pines—as most persons do.

There are nine native genera to tell apart:

Pines
Spruces
Hemlocks

Firs
Larches or Tamaracks
Southern Cypress
Arbor Vitæ
Junipers
Yews

In general, the Pines bear leaves which are long cylindrical needles, springing from the twigs in bundles of from two to five which emerge from a sheath at the base. The trees do not have a characteristic shape when well-grown, but are wide and spreading, their outlines foliaged in soft billowy clouds, their trunks and rugged lateral limbs usually unclothed and visible from afar.

Spruce leaves are short, angled, not bundled together, and point in every direction from the twigs. The Spruce, our standard Christmas tree, is sharply pyramidal in outline.

Hemlock and Fir seem at first sight much like Spruces. But the Hemlock, a giant and towering tree when full-grown, has short flat leaves growing out from the twig on two opposite sides only. The Balsam of the mountains is the only Fir in the East, and thrives only in higher altitudes. Its relatively *smooth* trunk is characterized by numerous blisters under the thin outer bark, yielding, when pricked, the balsam of medicine and commerce. (This is both delicious and efficacious as a

cough-remedy, a drop or two being put upon a lump of sugar!) The Balsam is an even more symmetrical tree than the Spruce, but commonly has a scantily clothed appearance, due to its rapid growth and scanty tertiary twigs.

The American Tamarack (the Indian name for Larch) sheds its leaves in autumn, and produces an exquisite series of form and color changes when unfolding its delicate thin needles during spring. Threadlike, light-green leaves come out in whorls from lateral buds along the twigs elongating and darkening as the season advances. Tamaracks favor boggy areas in forest lands, and are elsewhere but casual and infrequent denizens.

The tall Cypress of the South, also deciduous, does not need to be distinguished as it is common and well-known. It rarely appears as far north as Maryland.

Arbor Vitæ is usually called White Cedar. It does not grow large, hardly ever taller than thirty feet; its lateral branches curve upward rather than spread sideways; and the shape of the tree is that of a narrow cone. It can scarcely be confused with any genus except the Juniper. Both are small and tower-shaped, and both grow on thin soil and in waste places; but the White Cedar has its twigs closely *shingled* by flat and very short leaves, bears

a woody cone, and is not so brightly green. The Red Cedar of the Juniper line produces, instead of cones, the blue, round juniper berries of commerce; its twigs do not appear flat, but are pronouncedly cylindrical or string-like.

The Yew, with us, does not grow to a tree form at all, but looks like a spreading, ground-hugging shrub—possibly to be confused with hemlock saplings—but its leaves are darker, longer, and heavier than those of the hemlock, and more rigidly fixed to the twigs. In spring and fall its striking little coral-red, odd-shaped fruits, identify it at once.

Identifying Six Turtles

ANYONE much given to rambling about the country in the East will sooner or later happen upon at least six turtles all of which are easy to identify.

The largest, and the only one which there can be any danger in handling, is the Snapping Turtle. This species is also the only one of the six whose shell does not completely protect its legs and head. Evolution in this case has sensibly concluded somewhat to sacrifice protection to agility and aggressiveness. Its head and tail as compared to the others are all out of proportion to its size. The plastron below and the carapace above (particularly the former) are of less importance in perpetuating its life than its powerful legs and savage jaws. Most of its time is spent in mud, or in crawling along the bottom of streams. Beware of those jaws! A Snapping Turtle can be lifted by his grip on a stick—no matter if he weigh thirty pounds—and held suspended for minutes at a time. The only safe way to carry one home is by fastening a rope around its tail—and even then its head must be kept well away from one's calves and ankles! (Look for its eggs in June covered a few inches deep in sandbars and mudflats.)

Much smaller but, as Ditmars describes it, "in habits and looks an understudy to the Snapper," the Musk Turtle is common and also rarely leaves the water. A positive means of differentiating it from a partly grown Snapping Turtle is its musky odor. No other characteristic need be described, except the carapace which is well-arched and fairly smooth.

A third water turtle (it is really a terrapin) is the Painted species. The crimson and yellow lavished on its underside readily distinguishes the Painted Turtle from the other five, and it is never more than six inches long, usually less. A dainty, likable little pet, it is abundant in all fresh water ponds and streams, and can easily be introduced into the home aquarium. But it will invariably kill or mutilate the smaller fish therein in spite of its innocent and esthetic appearance.

The Spotted Turtle, almost always to be found in company with the last, and of even smaller size, can be identified by the many round yellow dots on its shell. These last two are pond turtles. They bask on logs or other objects and are difficult to approach as they slip into the water at the slightest noise. There is practically but one way to capture them. Since they hide in the bottom grass and weeds only a few feet from where they dive, a

person by cautiously wading along and probing with a stick can often turn one up and seize it.

Both the Wood Terrapin and the Box Turtle are likely to be found out of water, the latter rarely venturing in except in the fall when it digs itself in for hibernation along the bank of a pond or stream. The Box Turtle, as the name implies, can literally box itself in, both the front and rear of the plastron being so hinged as to shut in legs, tail and head completely. The Wood Turtle, although it has no hinged box-cover, has the ability so effectively to pull in its members that a dog can worry one of them by the hour without harming it. Since the fleshy parts of this woods-dwelling and gentle-mannered turtle are a bright brick-red, one need look no further for certainty as to its identity.

There are, of course, dozens of other rarer and more localized turtles and terrapins, but having identified these half-dozen, further progress in familiarity with the order must be sought from reference books and keys of identification.

Captured turtles can be tethered by a twine run through a gimlet hole in the rear edge of the upper shell, or kept in a small pen of chicken wire. They will sometimes lay eggs in such a pen if it is in a secluded nook—especially if captured in May or June.

Merely a Matter of Taste

It is curious that a nature-lover does not feel that he has identified a plant, bird, or animal until he has actually seen it. He is not content to identify a Tanager by its song or a Lynx by its scream. Being the visually minded folk we are, we habitually ignore and play down our other senses. Scores of odors pass unheeded; only the most experienced naturalist will instantly come to attention at the slightest strange note that comes to his ears, and he will usually attend only to those which are in his particular field of interest; and as for new flavors and tastes, how few are even curious enough to sample the plants to which they may be able to attach the correct label from books! Yet, almost everything vegetable has a distinctive taste, and almost none yield a sap actually poisonous in small quantities. The world of the tongue is yet hardly explored and mapped at all!

Leaving out of account our well-known fruits and nuts, which everybody eats, Nature has provided and reserved for the enjoyment of her regular communicants, a select store of confectionery. To know of these dainties and where to find them

is to unlock another of the quiet secrets of the Outside; a keener and more catholic pleasure comes from the enjoyment of them. Wild honey and maple syrup, of course, stand in a class by themselves as sweets: choice enough for epicures, available enough for farmhands and ramblers. These, too, we leave out of consideration: they are staples not luxuries.

The little Wintergreen plant which originally taught commerce a new flavor and furnished its sole supply—but which no longer does so since a prosaic chemist synthesized it in his laboratory—can be one of the first acquaintance the tyro taster makes since it is very common. A book can tell how to locate it and identify it through the eye; but can convey no hint of what a delight it is to nibble the reddish new spring leaves or in fall to munch the pulpy berries. Creeping Snowberry, a different looking groundling, has much the same delicate ichor in its veins. Wintergreen, since it is so common, must have been intended to be one of man's most favored flavorings. The Black Birch's twigs—and it a towering forest tree—harbor in their cambium layer (inner bark) a delicate sap whose chemical composition is akin to Wintergreen. The long-forgotten source of the birch beer of our pioneer forefathers was the Black Birch

tree: nowadays the concoctions bearing that pseudonym have not the remotest relation to birch flavor or origin.

Muskrats—and some people—like to pull Sweetflag up out of the mud along the meadow brook and nibble its rugged root-stock. Two generations ago these were commonly dried and, as imitation orris root and calamus, scented the bureau drawers. Another root, aromatic and pungent, is that of Wild Ginger. Even if the artistic quaintness of the Ginger flower is more appealing than the spicy root, some palates find the latter attractive. It is a sturdy, vigorous little plant which distills its ginger from the sluggish damp mold where one would not have imagined that essence existed at all.

The Mint Family presents a wide range of aromatic juices, among which Catnip, sacred to all felines wild and tame, and Spearmint, of recently revived fame, rival Peppermint in commercial notice. All the mints are very much alike in appearance, all have square stems, and many smell as pleasant as they taste.

Wild Water Cress growing along tiny brooks, often so thick as to choke the stream, and tasting like slices of crisp radish, makes a famous table salad and yields a pungent nip as one walks by.

In the late summers, some pastures are lush with

Mandrake Apples, a plant which the cattle will not eat. The beautiful, lemon-like apple when dead ripe, shares with many other dainties the quality of a little going a long way, the first few are eagerly eaten—then one's desire is suddenly satisfied.

Who has not seen a country boy pick the blossom-heads of red or white clover, pluck out the flowerets and, biting into the tips of their nectaries, suck the tiny globules of sweets kept there for other purposes? "Where the bee sucks there suck I," sang Ariel. When it comes to regaling himself in such manner from Clover, Columbine, Toadflax, Squirrel-corn, and a dozen other blossoms, every unspoiled country boy is a natural Puck.

The resinous, piney quality of the conifers comes to you in sampling juniper berries from the Red Cedar—a truer quality by far than comes from cocktails of the gin of commerce made from fermenting its berries. Their rich huckleberry blue, stippling the dark green foliage, form one of the finest of Nature's color combinations. Confectionery, commercial or natural, has to appeal to the eye as well as to the tongue!

The Sassafras still holds its own as a world flavor producer. The perfume which may be inhaled from its crushed leaves in the hand, as well as its taste, makes this little tree worth singling

out. It is perhaps the only tree which has three different patterns for its leaves; as though it had not made up its mind which to adopt. In the same family group the Benzoin, under the alias of Spice Bush—a shrub whose yellow flowerets suddenly plate its bare branches in early spring with richest eighteen-carat gold, so that it is in reality a Golden Bough—yields a characteristic taste, more refined and delicate than the emphatic Sassafras.

Spruce gum, forerunner of the chicle products which have now become one of the pillars of the advertising business, has only to be sampled from the trunk itself, deep in the Great Woods, to be appreciated. Then, there is the Slippery Elm. Having learned to distinguish from its two commoner brethren, shave off the bark until you reach the white cambium beneath, put a few slivers of that into your mouth, and thenceforth you will be on more intimate terms with the woods. Once you have learned to chew spruce gum and slippery elm with the gusto of a backwoodsman, the artificial stuff sold in germproof (!) profit-sharing packages, will for you have lost most of its appeal.

September in the eastern states brings near to ripeness—but not too near—the Wild Grape. Bushels of the clusters may be gathered in an hour or two, and these need only be boiled for a few

minutes and squeezed in a stout cloth to extract the juice, to provide the real thing in natural nectar. Bottled and stored away in concentrated form and brought out around Christmas time to be served diluted and sweetened, it yields a magic which can bring back the sun and the colors of September to midwinter firesides.

Nature's confections, given without money and without price, admit of no adulteration and bear imitation no better than wild strawberries. More is meant than meets the tongue when one goes sampling into the great larder of the Outside.

May Fly Mathematics

"So careful of the type she seems,
So careless of the single life."

How is the astonishing prodigality of Nature's processes better exhibited than by a swarming of ephemeral May Flies? Comes a day in June or July—there is no foretelling the week of it in advance—the vicinity of a lake or river is suddenly overcast by millions of these insects: they fly into faces of passers-by, their weight bends and breaks twigs, they carpet pavements, they hide walls—a fluttering, dancing, yellow-green cloud. A dance of death! An aimless rigadoon of the condemned! A sunset or two, and they have vanished from the air; their legions are gone—not one remains. Some days later another insect storm gathers and breaks; perhaps there may come three or four such repetitions; but of them all, these children of a day, not one will glint in a third sunrise.

Life, life without stint or limit, is the urge which drives these gauzy-winged creatures to emerge from the lowly larval stage in the water and mud of stream bottoms, to transform at the surface to

winged images, and then to burst into instant flight to seek the shore. During the next twenty-four hours they transform again—cracking their fragile skins asunder—into the final adult stage and the day following live out their three-score-years-and-ten in hectic company with myriads of their fellows. Although she possess only a rudimentary mouth and a stomach which cannot function, a single female can lay nearly a thousand eggs in her day of living—but how few of those eggs will succeed in becoming adult May Flies! Fish, frog and newt may well look forward to these swarmings as high feast days of the year! They eat the May Flies until surfeited; but they make no apparent inroad upon the limitless hordes that sink back to the element from which they sprang. And not only are the adults eaten at laying time, but all through the year their larvæ form a staple diet for dwellers in the depths. In midsummer, perhaps six weeks elapses from egg to egg but, as soon as the waters chill a trifle, no more metamorphoses take place; the birth of the adult awaits another season.

Why do these great culminations of emerging imagoes occur on certain days, and bring forth their millions? One observer reports that in the

center of Lake Erie in 1910 buoys were covered six to eight inches deep with May Flies. Along the St. Lawrence I have seen them fill up street gutters and darken windows. In western Connecticut I once saw the entire clapboarded side of a country schoolhouse hidden by these clinging ephemeræ and their cast-off skins. The machinery of river steamers in the Middle West has been clogged and stopped by their swarms.

The little crawling, squirming larvæ in the creek bed may be identified by looking for a half-inch thing which bears a tail of three slender wide-apart hairy appendages, much smaller than damsel fly larvæ which are also three-tailed. They can be reared to adulthood in any large aquarium if protected from enemies and constantly supplied with fresh water. The energy needed by the May Fly for the amazing amount of flying about it does during the mating dance and the egg-laying process, must come from the food it eats while in the water stage. Hours and hours of restless, ceaseless flying—where and how in its tiny frame can such energy be stored?

As unto the pure all things are pure, so perhaps to the May Fly all things in the cosmos are May Fly. Thus they may perhaps justify to them-

selves their lavish yet niggardly existence. For all we know, they may consider themselves the flower of evolution, the reason for the universe's existence. Only to a will-to-power can we ascribe May Flies. Better fifty hours of flying than a cycle on the earth!—may be their point of view.

The Complacent Porcupine

An enlivening detail of a tramp through the backwoods country of the eastern states before the leaves have come out in the spring, is spotting Porcupines. They are a common "varmint" from Canada to the Great Smokies. One may see a hunter's-dozen of them in a morning, dozing amidst the limbs of the bare trees, for all the world as if they had done a hard night's work. By their attitude of smug complacency, which sits upon them like a garment, they spread abroad the impression that they are of high account in life. (I once knew a man who, simply because he looked solemn, spoke rarely and chewed reflectively, gave to strangers the feeling that he must be engaged in some momentous undertaking. He was night watchman in a gravel-pit!) Porky, however, has reached about his proper level in human esteem. The universal conviction is that Porcupines are about the stupidest of animals. The "quills upon the fretful porcupine" protecting him with a thousand needle-sharp points, have made him one of the most dreary of associates—yes, the dreariest.

He doesn't need to flee from natural enemies—he has none, now that Fisher and Wild-cat have almost disappeared. He never has to seek for food, for he eats bark—any bark; were he economically of any use to mankind, he would be the ideal animal to domesticate because one could feed him almost exclusively on sawdust! As for building a lair, give him but a branch to sit on, and during eight months of the year he will sleep through the longest of days and eat through the longest of nights, as utterly pleased with life as a newly-elected legislator. Porcupines have little need of a summer lair, although for slumber they prefer crevices among rocks to the disturbing sunshine; it is only when the young are born that mother exhibits any traits of a retiring disposition.

Porky's forwardness in intruding into the tent, blanket, and supplies of the camper is proverbial and infuriating. Only a surpassingly ignorant creature could be so blatantly lacking in consideration for another's privacy, so wholly unmindful of the simplest amenities. An abandoned passion for that condiment causes him to take everything with a grain of salt. If given time, he will completely masticate an empty porkbarrel for its sodium chloride flavor and during a winter will readily eliminate a whole kitchen floor from one's cabin

for the saline suggestions it may have absorbed from summer cooking.

One needs to be as cautious about leaving loose Porcupine quills lying about as he would be with stray fish-hooks or needles. They cling to clothing like burrs and, cunningly barbed at the base, work into flesh like a wood-tick. What suffering they can inflict upon an unsophisticated dog! We had a hound once who *would* have his impulsive moments and wax truculent toward the Porcupines around camp. Then it would take three strong men, two kneeling upon him holding his legs, the other manipulating the pliers, to remove the quills from his lips, mouth and tongue.

A grizzled Adirondack guide once growled to me over the breakfast fire that "them pests with thur *ingrowin' faces* is the humliest critters livin'!" Although one of the prowlers had gnawed a hole in his new pack-basket the previous night and the remark was prejudiced by that incident, I agree with the indictment. But with a reservation. There is one thing with a clearer title to superlative plainness of feature. Even as the stock answer to "What is worse than finding a worm in an apple?" is "Finding half a one!" so one may say that what is "humlier" than a porcupine, is a half-sized one! The youngsters are as nondescript as they are

homely. One May day we happened across a mother and the first small pincushion of a baby we had seen. There was a wild scrambling and a puppy-like whining from the parent to draw us away from the hollow under a stump which was the family den. Running to the stump, I stopped the opening with my foot before the little fellow reached it. How we laughed at him! He moved over the ground without showing his legs at all, and his shape—quite indescribable. Never was an infant less winsome than this bristle-covered eight inches of life, whose head and tail so duplicated each other that it seemed he might slide forward or back with equal facility. "Why," shouted my little girl, "it looks just like the top of our ice cream freezer!"—There you have its shape to a jot!

Rarely are there found more than two in a litter, usually but one. I marvel how even two such prickly animals can get along domestically together —it would be impossible, it would seem, were the juvenile quills not so bristle-like.

Every time I have disturbed one of these families in the backyards of civilization, I have been moved by the mother's apparent distress, knowing all the while, however, that her flouncing about and whimpering were mere zephyrs of emotion in a

whole lifetime of doldrum calm. She has few troubles in life to upset her. Aside from the stolid 'Possum, there is no quadruped north of the Mason-Dixon Line which shows such absence of that strained, painful alertness, that eternal vigilance, which is the price not merely of peace but of existence. Here, as with 'Possum, Armadillo, Turtle, Woodchuck, it is demonstrated that the life of security is the death of adventure; that 'tis better to have lived and lost, than never to have lived at all; that complacency is the mother of dullness.

The Pixie in the Pansy

NEARLY everyone thinks he is perfectly familiar with pansies. But there are so many secrets in out-of-door things, so many thrills for watching eyes, that one need not be surprised to learn that even the innocent-faced pansy has been shyly keeping a secret from him.

She has. And the quaint, velvet-petaled, open-countenanced flower would never reveal it herself —she couldn't. Some botanists must have found it out. Only botanists would be pulling pansies apart, for that is just what has to be done if you wish to see the Pansy Pixie. Pansies have always suggested flower-brownies, garden-gnomes—there is even a better reason why they should be so thought of.

Gently pull off the four *upper* petals of a Pansy that is newly opened. You begin to see her: Pansy Mab! Then, with your fingernail press across the top of the little tail or cup that forms the bottom of the fifth petal—as in all the violet-pansy kind —and break off the petal there. Now, sitting with two tiny legs in the bath-tub of this cup, you will see the charmingest mite of a fairy being, one of

the Little People for sure! Finally pull down and off the "tub" and you will reveal her delicate feet soaking in a bath of perfumed nectar. Try it! Pansies will mean more to you after you have seen that tiny dryad hiding in each one of their hearts.

What are the several botanical parts that make up this little lady? Head, body, legs, feet, and tub? Ah, that is something you can only learn with a glass and a dozen flowers of different ages!

Katy Did

SHOULD you be of an adventurous mold, not satisfied with being told in print how this testy little dogmatist actually says "that undisputed thing in such a solemn way," you can look into the matter for yourself. Like the poor, whom we have always with us, Katydid does not simply condense out of September air, though it would seem so from the amount of noise he lets forth suddenly upon a certain quiet evening, but up to this point, has been swinging around his life-cycle industriously and quietly aloof. Were it not for this strident sound, hardly anyone would know he had at last grown up: but when he is heard in early fall he seems a thousand-fold more abundant than in summer.

It is autumn when he starts to speak: the old New England saying is "six weeks to frost" after the first one is heard. No insect is a *vocalist*, since none breathes through a mouth or throat, so Katy's is merely instrumental bravado—not a voice at all. If, then, the performer is a musician, the touch of whose loved instruments gives hope and fervor to

his obstinate argument, where and what is that contrivance?

How does a Katydid do it? To learn the answer, first catch your Katydid—a thing not too easy in daylight and still more difficult at night for, though a tree may be full of the disputants on a warm autumn evening, they cease bickering immediately one sets foot on the ground below or touches the trunk.

By taking a Katydid in your hands not only can you see just how it is done; you can produce the call yourself by manipulating the larger pair of wings. By so doing you can make this minute phonograph play its single record, and with such unexpected and startling distinctness that you are likely to drop it from your fingers in surprise. To play a brand-new musical instrument so successfully the first time is most unlooked for; but the technique required is merely to rub the delicate flattened triangle at the base of one of the outer wings over the similar disk on the other. Clear and sharp comes the accusatory "katy-did!" The insect can reiterate this call fifty or more times a minute.

The pretty effect can be imagined—if not seen —when at night a grove full of these tree grasshoppers is vociferating, every insect giving his lacy green wings a double sidewise flirt at each call

—a triple or even a quadruple flirt sometimes, if the deponent be upon the negative side of the argument. . . . Be it here noted to the everlasting credit of the female of the species that *she* never mixes in the dispute. Oddly enough, only the males throughout the insect world are musically inclined.

Nothing can pack the air so full of sound as two score of thoroughly convinced Katydids, unless it be the deafening tumult which jars your tympanums when standing beside a pond of peeping Hylas. In either situation, you can barely hear a person's voice beside you. Despite this rushing cataract of sound, Katydids are astonishingly sensitive to approaching footsteps—probably they feel the slight jar of the earth running up through the branches. The sound of voices, or the crackle of a twig underfoot, will instantly silence most of those near-by and even some of those at a greater height. Nor will they resume fiddling until reassured by a period of quiet. This sensitivity to sounds may be connected magically in some way with the odd fact that Katydids literally and truly hear with their elbows. Don't take a book's word for it—examine a front leg at the second joint: it is a typical insect ear.

As colder and colder weather comes, the members of the local group become silenced one by one

until, on the evening of the first killing frost, only a single weary, unenthusiastic debater may be left to utter his dogged contention.

The northern limit of the Katydid's range appears to be along the Mohawk Valley and south of the Catskill Mountains. Above this latitude I have never heard one.

Birth Control in Birds

At first thought it seems rather miraculous that the ancestor of our common hen—probably the wild Jungle Fowl of Java and Borneo—could be bred through many generations until it is able to lay over three hundred eggs a year. Originally it never laid more than a dozen eggs per sitting, and two sittings annually were the limit of its accomplishment. But there is a stunt which can be worked with the common Yellow-winged Woodpecker, or Flicker (she of the thirty-two local names!) that makes the laying machinery of a thoroughbred White Leghorn or Rhode Island Red seem not quite so astonishing.

The Flicker excavates a hole in dead wood nearly large enough to admit a small human hand. Often the hole is dug in a stump so close to the ground as to be reached without climbing. If you have observed a pair of these Woodpeckers digging out their nest, or find one where the eggs are just being deposited, you can often enlarge the opening with a knife so that you can reach in and remove them. Take out all but one egg—but, mind you, the set must not be completed when you do this.

The eggs are so pearly white and semi-transparent that a perfectly fresh one can be detected at a glance. Normally the female will complete her clutch with six or seven eggs, sometimes with five, occasionally with eight. But, by leaving one as a nest egg and removing one more every day, you can induce her to go on laying. There is one case on record where 71 eggs were removed from the nest of a single Flicker in a period of 73 days! Another bird laid 37 in 50 days. The writer once succeeded in depriving 31 young Flickers of futurity in this manner. When the bird has been egged on to the limit of its quantity production, or nearly so, the size of the last few eggs slightly diminishes, and she usually ends with a runt not more than half the normal size.

As to the ethical or moral side of this experiment, we make no comment. Obviously it sets at naught the domestic efforts of one pair for one season. In most States which protect their bird life, taking eggs is unlawful without a collector's license—hard to obtain except for serious purposes. But it is an established fact that egg-laying is, to a greater degree than is commonly supposed, under the control of the layer. Whether these extra eggs are fertile could be readily determined by replacing them—or a few of them from time to time—

in the nests of other Flickers and noting results.

It is commonly supposed that robbing a bird's nest snuffs out of existence just so many potential nestlings. Such is not precisely the case. If but one or two eggs are taken, the mother will rarely desert the rest of her clutch, but will persevere and hatch them: hence there would be fewer offspring that season. But if an entire clutch is destroyed through accident or collected for scientific purposes, most birds within a fortnight or so, will have started producing another set, so that the season's total output will not be affected. This may not be true of hawks and owls, or of many of the larger waders and water birds, but is true of practically all the smaller land birds. Here is another instance of Nature's reproductive margin; wide enough to make up for the great number of accidents which befall nests and their contents, a number only comprehensible to a person who has had much experience observing nesting birds. Squirrels, marauding Blue Jays, Redheaded Woodpeckers and Crows, grazing cattle, hungry skunks, weasels, foxes and snakes—to say nothing of floods, winds and late forest fires—take an annual toll to which human destruction is as hundredths of one per cent. Killing an adult bird, however, is quite a different matter, as this slackens the fountain of life at its source.

Our common Cowbird, which builds no nest, sometimes hangs around for days awaiting a chance to deposit an egg in the nest of one of the smaller birds, to be hatched and raised by its foster-mother. Therefore, she controls her laying to suit that plan. In this procedure she is probably more adept than any other native bird, for one may often find orphan eggs not in the place where Nature intended they should be brooded. It is not uncommon to find Robin's eggs on the ground. My notes show that I have found them beneath a coal car on a railway roadbed, on dry leaves in open woods, on a haycock in a meadow, and on a village lawn! Once I discovered that deep blue gem, a Catbird's egg, at the foot of a short stake in a strawberry-patch. I found a Quail's egg under a tilted railway tie along an abandoned track. I took a Chipping Sparrow's egg from a niche in an orchard stone wall. A friend, whose word I trust implicitly, tells of collecting a Robin's egg from a Crow's nest one day in mid-April; a nest to which he had climbed fifty feet and found holding only this freakish anomaly. And—as Mark Twain would say—I've seen the egg! Wild Ducks sometimes deposit their oval green treasure in waters where they have tarried a night on their northward migration. As sound eggs do not float, one can only

see these foundlings on the creek bottoms where they lie—quite out of keeping with their muddy bed.

The American Cuckoos, both Yellow-billed and Black-billed, seem to be reforming from the failing of their relatives abroad, whose habits are similar to those of the Cowbird. Their eggs are brooded from the time the first one is laid—most birds wait for the full clutch—so that one finds fresh eggs in nests with young birds; and, on two occasions, I have found unincubated ones on the very outer rim of the shaky platforms they call nests. These irregularities, reveal a sort of unskillfulness in housekeeping affairs, as though they were novices recently induced by some cause or other to give up the Cowbird and European Cuckoo type of maternal profligacy.

Uncommon Senses

That man has five senses has been one of the truisms of physiology since that science existed. A few years ago, however, laboratory experimenters declared that there is no such sense as touch, but that there are at least three distinctly different kinds of touch organs, giving us tactile, pressure, and pain sensations, respectively.

And now it has been generally accepted by naturalists that animals possess sense organs which man does not; that plants not only have two or more sense mechanisms, but that all the strong emotions known to human beings have counterparts among representatives of the plant world; and, furthermore, that some animals have means of detecting stimuli and reacting toward them in ways almost beyond finding out. Such, for example, are the homing instinct mechanism of pigeons, bees, dogs, cats. The migration urge among birds, and the age-old routings they follow because of it, seem to transcend human abilities.

Biologists, in coöperation with the United States Department of Agriculture * have recently

* A letter to the Department of Agriculture sent by anyone actually interested in trapping and tagging birds under their

attempted to plot some of these avian trade-routes, by tagging all types of birds all over the country. Tagged, or dyed, gulls and terns nesting on the so-called bird islands in the Atlantic off the Carolinas afford startling proof that they possess a real sense of direction. Birds shipped in all directions in darkened cages, in some cases sent on such long journeys as to require four days of flight to get back, invariably returned in about the time required to fly the distance unwaveringly. On the other hand, tests made with bees, which nearly always came back when liberated over land within four or five miles of their hives, demonstrated that when set free over water, nearly out of sight of land, they could not find their homes—a seeming proof that familiarity with the landmarks roundabout by sight gave them the homing ability.

A series of experiments has also been conducted with bats. This denizen of the night, unique in many other ways, needs eyes very little to get about. Doubtless he will eventually lose them. For the night-flying bat, it was shown that eyesight is unnecessary. Bats kept blindfolded for a year, and then transported to strange rooms, flew

direction, will procure the details necessary to engage in this country-wide research. It has already attained a large scope of operations.

about with amazing accuracy. Silk threads were strung for them to fly between and "when these threads were placed still nearer together, they contracted their wings in order to pass between them without touching!" Amongst branches they flew without difficulty, and hung themselves up to sleep on unseen supports here and there just as if these conditions were not unusual to them. No matter how they were startled or with what speed they flew, they were able to slip between the threads or branches without running afoul of them. On the bat's forehead was discovered an area of fine hairs which appeared to be so sensitive to sound waves in the air that the infinitesimal echo flung back by a thread from the whirr of the wing-beats gave warning of the thread's proximity. It does not seem credible that by this means a bat while upon the wing can capture insects; but certainly a bat's eyes are too small and buried too deeply in furry sockets to be very useful for that purpose.

The common little red bat of the East (*Myotis licifugus*) can often be caught in its roosting-places: behind closed house-blinds, in a dark corner of a barn, in the hollow of a tree or stump, or in the attic of a deserted house. If held by the skin of the back, so that they cannot bite with their tiny

sharp teeth, they can be studied at leisure. The sensitive forehead areas can be easily detected, and the half-rudimentary eyes found.*

We think of a bloodhound's power of picking up the trail of a man or animal across rock, sand or gravel, perhaps a day or more after it is made, as a sense of smell similar to our own, only infinitely more refined; but what shall we name that organ by which male moths can detect a mate as much as a mile distant? Yet if one places a female as lure behind his window screen, from three to a dozen males will invariably appear in a night. The moth's antennæ, which are able to smell so keenly, might be thought of as extroverted nostrils; but their capacity for detecting odor is evidently superhuman.

It is, of course, largely a matter of definition whether the semi-lunar canals of our inner ear are classed as sense-organs or not. Without them we should have no notion of balance. The juggler and rope-walker have succeeded in training this sense to fine degrees, but what have we to compare with the balancing of the swiftly maneuvering swallow? A cat always falls on its feet—alas, we

* For an interesting account of its habits, read Stone & Cram's *American Animals*, page 200.

do not. A goshawk swooping at his prey faster than sixty miles an hour must possess an eye which focuses far quicker than man's. And, speaking of eyes, it is not a special sense-property of an animal's eye, as commonly supposed, which makes it shine in the dark. Nearly all animals that prowl by night have wider-opening irises than daylight creatures. When the iris is fully open, the widely revealed retina behind forms a mirror which reflects even the dim light of a starry night—the eyes do not *glow*. One naturalist says that man's and the opossum's are the only eyes that do not show this effect. Animals which can see in the dark do so by virtue of having eyes which open wide enough to catch all the light there is; they do of course not have a special sense of night-sight.

Mankind's senses in general are at a very low level of development compared to parallels among lower animals. Hounds and insects smell immeasureably better. Buzzards, and most other birds, have keener sight. Bats—both make and detect sounds which we cannot hear at all. And Francis Galton's super-pitched whistles proved that dog's ears have a range considerably above our own. Squirrels, by a delicate sense of weight, tell bad nuts from good even when green and encased in

heavy husks. Taste seems to be the only sense in which man excels, and this is the one we least employ except at table!

Science yet wonders vainly what sense it is which enables certain of our common wasps to locate unerringly the nerve ganglia in its caterpillar prey, so as to paralyze but not kill it with a series of anesthetizing stings. Fabre tells us of another wasp which has the ability to discover where, underground and encased in a mud plastered capsule, the grub which is its food has taken refuge as a pupa.

In another place we have put the question whether moths can detect colors in the dark, since so many of them are intricately marked and in bright tints. This is a problem in sense organs which would baffle the neo-Darwinians to account for. What part can moth coloration play in the perpetuation of the race? What survival-value have such patterns or colorings? For the markings are concealed by means of various protective resemblances during daytime and, after dark, when their bright colors are revealed, how can they be *seen?* If not seen, if not appreciated as a matter of selection by the female, what has caused them to develop and to be perpetuated? Since there is, as far as I have ever been able to determine, little or

no evidence that a female will refuse to mate with the first approaching male—so that there is little or no sex selection among them; and since the concealed markings are of no account in saving the wearer from enemies in daylight, where is the working of natural selection?

Oh, well, common sense is yet another uncommon sense which a nature-lover may possess for the finding and solving of such mysterious matters as we have here set forth.

What sort of sense enables the ichneumon fly (*Megarhyssa*) to detect the grub of the horn-tail woodborer (*Nemex*), from a half-inch to an inch deep in the trunk of a hard-wooded, though dying, tree; and to know where to start auguring-in with that remarkable ovipositor of hers? She eventually strikes that helpless and destructive little larva and in it, or in the channeled boring near it, she lays an egg the fruit of which will become a parasite upon the horn-tail and will devour it.

That patient and astute old gentleman, Monsieur Fabre, found after years of clever experiments, that the solitary bee (*Osmia*) actually controls the sex of the eggs it lays. Now, certain microscope-wielding biologists recently claim to have produced evidence that there is in the egg-cell (at least in that of some of the lower inverte-

brates) a sex-determining chromosome—they have named it the Y-chromosome—which determines the sex of the ovum from the moment of fertilization. But *Osmia* appears to adapt the sex of its progeny to the size and shape of the cavity into which it deposits its long-since-fertilized egg. It is well known that our common honey bee raises neuter workers, male drones, or queen-mothers, apparently from identical eggs, by varying the type of food given to the growing larvæ. But Fabre contends that, although *Osmia's* young are nearly of the same size and shape and are fed identical rations, she desires the females of a given nestful of young to emerge first and, unless circumvented by a canny French entomologist, will see to it that they do. Moreover he can cause her to reverse the scheme, and the first emergers are males. What birth-control is this! . . . What sense have we as a counterpart?

Ten Earliest Spring Flowers

If one has already made a good start upon the wildflowers, this chapter is not meant for his eyes. But consider those luckless wretches who are just embarking upon the conquest of the botanies—what a campaign lies ahead of them! What a disheartening array advances against them! The task is not unlike mastering French—as the French speak it. Yet, even as a foreign language is readily learned in its native country, so beginners in the language of wildflowers will find themselves in no strange land—for the vocabulary lies everywhere about. What introductions to new beauty, what raptures of discovery, are just ahead!—to which the practiced conquistadore has become, alas, so accustomed that he cannot participate in the beginner's artless enthusiasm any more forever. In the finding, in the learning, in the doing, not in the destination, the *fait accompli*, lies the richest savor.

We will suppose that the ten earliest wildflowers in the middle and northeastern states—flowers of the sort one might naturally be tempted to bring home—will be as follows:

Skunk Cabbage
Hepatica (Liverwort)
Arbutus (Mayflower)
Adders' Tongue (Dog-tooth Violet)
Bloodroot
Early Saxifrage
Spring Beauty (Claytonia)
Wood Anemone (and Rue Anemone)
Trillium (Wake-robin, or White Trillium)
Squirrel-corn (or the closely related Dutchman's Breeches)

These form a group easy to start on. They are all common and of wide range. Late March usually, and all through April, is their flowering season. To identify these when few other blooms are about to confuse one, at a time when the zest to get outdoors is keenest, and when the unfoliaged woods are open and freest with secrets, is an easy and satisfying achievement.

In addition to the above ten plants, there are five trees that blossom equally as early: the Elm, Red Maple (flowers of two sexes, differing in color, appearing on separate trees), Carolina Poplar, Spice Bush, Pussy Willow and a little later, Shad Bush. And Jack-in-the-pulpit, which everyone knows who has ever set foot in the woods, will be pushing up from its shallow-set bulb, to be in its prime by May first.

Insect Suns

—Or, since the light we are to speak of is a night phenomenon, would it be more apt to call them "insect moons"? But there is only one explanation for the moon's refulgence, and that is well established; while for the unvarying heat and light of the sun there are at least five distinct theories. How can fuel be available to supply that unthinkable radiation throughout the limitless eons of time? Yet why puzzle so signally about solar energy? There are two insects in our very dooryards which offer problems as baffling!

Firefly and Glowworm, both common enough to pick up almost anywhere during the late summer and fall, have within their segments chemical laboratories renowned for secret processes and enigmatic formulas. Man's patent illuminating fixtures are coarse contraptions indeed compared to the organs these insects have developed. A carbon-filamented bulb sheds from its electric current a light-vibration which is only ten per cent of its total emanation—that is, only ten per cent of the rays from such an electric lamp can be seen. A gas flame, even with a mantle burner,

yields less than five per cent of light-efficiency. Sunlight itself gives as light only about thirty-five per cent of its power, the remainder being emitted as heat, as chemical rays, infra-red rays, etc.

But our two insects: their glow is practically a hundred per cent light! Their lighting processes are controlled by the amount of air they admit into the abdominal area through a system of aerating tubelets. Yet it is not an oxidation, or burning, process in the usual sense, since no heat results from it. Phosphorescence, the phenomenon was called until savants began carefully to investigate and discovered that no phosphorus exists in it at all! Neither can it be explained as radio-activity. The substance secreted by these creatures, which glows upon admission of air with a greenish tint so bright that book-print can be read by it in the dark if held close to the insect's tiny lamp, is a mysterious chemical. The Firefly's luminosity is much greater than the Glowworm's. A charming Japanese custom is that of hanging tiny wicker cages of these luminous insects about the interiors of their houses. In the far South of the United States a variety exists whose light is not given out in flashes like the northern *Photinus*, but shines so steadily as to look in the distance like a lantern being carried along. An old saw, beloved of peda-

gogues a generation ago, runs, "An ounce of luminosity is worth a ton of brilliance!"—here we have, as it were, a ton of luminosity from a grain of brilliance, due to the hundred per cent efficiency of this insect's mechanism.

The Greeks named Glowworms "bright-tailed ones," the Latin name means "lantern bearers"; both are more apt than our word. As a matter of fact, the Glowworm is not a worm at all; it is a beetle of the *Coleoptera* order. But the female, the one whose light we see about the damp ground on summer evenings, curiously enough, looks not at all like a beetle but only like a glorified Sow bug. Her mate, a true hard-shelled beetle, possesses the family wings but not a tenth of his partner's luminousness. Probably nothing has been written about Glowworms approaching in interest what old Fabre has set down in his book called *The Wonders of Instinct* (Chapter XIII). Among other amazing things he tells us that even the eggs are luminous, both before and after being laid; and that all through larva-hood, and even in the winter, so are also the immature beetles! These two facts, coupled with the further fact that the male Glowworm, the *seeking* sex, is luminous too, makes the whole matter of the reason for the trait extremely baffling. He concludes: "We can under-

stand the object of the feminine beacon, but what is the use of all the rest of the pyrotechnic display? To my regret, I cannot tell. It is and will be for many a day to come, perhaps for all time, the secret of animal physics, which is deeper than the physics of the books."

Neither is the Firefly a fly. It too is a beetle, and a relative of the Glowworm. They can be easily caught in the air as their flashes reveal their whereabouts. A dozen of them captured in the evening and imprisoned in a bottle, make material for a charming experiment. Next morning they may be studied with a magnifying glass for observing their exact appearance, an appearance few people seem to know for, to most, they are but disembodied light.

The School of the Sycamore

From Maine to Texas ranges a tree variously named Sycamore, Buttonwood, Buttonball and Plane Tree, sometimes in company but far more imposing when solitary or uncrowded. Then its wide-branching, massive limbs and stately trunk command attention. In winter and until May, it is hung with *golf-balls:* the seed-heads, securely fastened on by tough threads. In summer the large, maple-like leaves, forming splendid shade, the smoothness of the upper branches, mark it apart from other trees.

The artistic effect of the Sycamore is not attained by any other tree, native or foreign. The Kapok Tree of the East Indies covered with azure blooms; the Flamboyant Tree of India, the jungle's burning bush; the Pepper Trees, arching their splendid masses of red fruit over Los Angeles streets; the unrivaled foliage of our northern woodlands in October—each of these lend a glory to the earth. Japan's giant *Cryptomeria* Cedars are religious symbols befitting their solemn funereal use. The Banyans of the tropics form whole groves from a single trunk, the world's widest, as the

Sierra Redwoods are its highest and oldest, trees. The Elms of New England's meadows spread a natural benediction over the husbandman. . . . But the bark of the younger Sycamores is unique.

It ought to be striking a note for man's imitation and providing patterns for his arts, because its motifs are unique. But the latter appear as yet to be unrecognized. When the trees are full-grown this effect is lost except on the uppermost limbs. The bark of the Sycamore is smooth, and appears oddly tight. It does not split longitudinally with the growth of the tree, as is the case with most trees, so as to form strips and furrows as the trunk expands; it accommodates itself to the process of growth by shedding in irregular patches. Thus the whole surface of the trunk perhaps for fifty feet is a mosaic of grotesque patterns. "Much to the detriment of its good looks" writes one authority and others seem to think so too.—These remarks sound like comments of a conservative critic walking through a gallery of modern art! They are unimaginative; they are blind. If you pause to appraise it objectively, really let it sink in, its mosaics give a stunning effect. Ranging from a deep drab, through all the mixtures of gray, chocolate, flat yellows, subdued greens and russets—none of which shine or gleam—they produce a

cubist creation, with a color symphony in minor tones. There is never a touch of inharmony, never a juxtaposition that does not blend. It needs the direct undraped light of winter and spring upon it to bring out in full its richness; hence is at its finest when the tree is leafless. Also, through the year, the colorings seem to vary; from month to month it looks different. The Sycamore is a product of Nature's Futurist School. It was Future-ist before man-as-artist had any Past. Its slim, dully polished bole could be a fitting wood-totem for us of the tribe of Nimrod!

The Red Crossbill

In addition to the fact that the Crossbill is the only land bird in North America having an asymmetrical bill, it has other interesting characteristics. Its acquaintance in the United States must be made during winter, for it rarely, if ever, breeds south of the Great Lakes.

An out-of-true proboscis is not a common thing; indeed among the vertebrates any trait of asymmetry is rare. The American Oyster Catcher has a beak askew for operating on various bivalve shells. The New Zealand Crookbilled Plover has a probe turned to the right. Here the catalog stops . . . A good idea of the American Crossbill's oddity may be gained by imagining the lower mandible-tip of a parrot as closing up to the side of the upper one, instead of fitting within it. Singularly enough, like the parrots, the Crossbills readily use their beaks in climbing among branches.

The American Red Crossbill is at home in the endless coniferous forests of Canada. Apparently, in order to construct a bird competitor to the squirrel and wood-rat, Nature made for the Crossbill a magic tool, with which stiff pine and spruce cones

could be wrenched apart so that the rich protein-bearing seeds within might be eaten. It operates somewhat like a pair of wire-cutting pliers. The tight leaf-buds of hardwood trees in winter also give way to this twisted, sharp-edged instrument. In settled areas southward, we usually see the Crossbill at this latter occupation. But the severest of cold snaps and most protracted of sleet conditions sometimes drive the birds from the evergreen woods. Even then they come but a short distance into the States except along the highway of the Appalachians they may wander down into southern Pennsylvania and, along the Rockies, they may venture even further south.

They are social birds of gentle manner, remaining together in groups of a dozen or less. While busily feeding they keep up a continuous whispering, chirping gossip, not to be overheard very far away—as, indeed, gossip should not be. In central New York, I have seen little flocks in different years on December 26, January 10, and April 2. In the northern Adirondacks one July morning (for they do occasionally summer there!) I fed grain to a group of seven—probably one of that spring's household—and enticed some of them to hop upon my feet. With them was a quartette of juncos, the whole flock keeping up a *causerie* of

lisping talk. *Pater familias* was charming in his brick-red, plush-looking plumage, and his mate was nearly as richly raimented in plush which ran to quiet greens, drabs and browns. The youngsters as yet wore a nondescript and unskillful combination of their elders' plumage. In order to pick up the grain it was necessary for them to put their beaks sideways to the ground, as parrots do, for they could pick up nothing with the non-meeting tips.

The Red Crossbill has close relatives in the rare White-winged Crossbills, who seldom reach us, being more loath to leave the land of Athabasca and Saskatchewan. The two can be distinguished by the presence or absence of white wing-bars, for White-wing owes its name to them.

Have You Seen a Wild Fox?

THE Red Fox is commoner than is generally supposed. If he will adopt the fox's system of lying silently in wait in woods and meadows, or skulking along as softly as possible, a man will be almost as likely to surprise a fox as he to spy a man. I have discovered that many a Fox's den looked so thoroughly like a woodchuck's burrow—as, indeed, it may once have been—that one might pass it by for months and never suspect it. The fox, in other words, instead of trying to conceal its hole as much as possible, appears to realize that Woodchuck holes are of little interest to man and, at least in well settled localities, often hardly conceals at all the den it inhabits.

In spite of the immemorial contact of man with foxes, we have never studied Reynard as closely as he has studied us: he has a much more vital reason for such study. There is a vast amount of hokum abroad in the land regarding the fox's talents. However, he has doubtless exaggerated and misunderstood the ways of man, quite as much as men have exaggerated and misstated the wits of the fox. It is well for us that he has, for if foxes

could save their brushes whenever human danger threatens, the fields would be overrun with them. Often, but not invariably, Reynard shows astonishing skill in forming a new and improved strategy to cope with an utterly novel situation.

Our northern Red Fox, which is the species usually referred to when an American speaks about foxes in general, is a creature strikingly well adapted to be both pursuer and pursued. ("And that's why they call a certain type of lawyer 'foxy,' " a city friend of mine suggested recently.) Far better than any other quadruped, the fox combines an efficient ear, a sensitive nose and a keen eye. Either of the three alone would protect most animals, to say nothing of those hundred per cent legs to which he can safely trust as long as his reserve strength holds out.

In northern New York State it has been my experience to glimpse foxes oftenest when I was not looking for them. Either I would come upon one unawares as he lay dozing on a sunny knoll, or one would come trotting past while I sat resting. Just as individual dogs differ greatly in their dependence upon eyesight so, I suppose, do foxes. Some of them, at least, have seemed to me to depend on scent as exclusively as a prize hound,

and have blundered right upon me, from windward. Some have the wise habit of doing their daytime sleeping in the open, selecting a place with a wide lookout and, unless repeatedly disturbed, frequenting it daily for months. From such spots foxes detect the approach of a possible enemy long before it can catch sight of him. I well remember a small piece of half-dry, half-wet swamp near my home in the old days among the treeless pasture hills of an abandoned farm. Perhaps a dozen times I was able to steal over the knolls and send a red streak darting to cover, for it was a favorite spot for foxes to doze in, even after early snowfalls. Occasionally—not often—I have heard them bark away back on the hills during moonlight nights. Their cry is a querulous little yelp with a note of wistfulness in it. The resounding ululation, or baying, which is a hound's birthright is by a fox modified into a long-drawn husky screech; a sound much like that made by a shaky and half-blind old house-dog.

Commonly a fox will not see you if you are still, though he will never fail to scent you if you approach from windward. I have mentioned having met a fox suddenly face to face. Is there any thrill comparable to that which such a meeting gives you? This lithe, wary creature slipping right into

speaking distance—it upsets you instantly into a trembling buck-fever. How utterly effortless his gait! It has the same quality of motion you note in a leaping wild deer or a thoroughly startled grey squirrel. When he is running before the hounds a fox's brush ripples along behind him, actually doubling the apparent length of his outline, undulating liquidly with each jolt of his body, and helping him to veer quickly. By following a running fox's trail in the snow a few rods you can tell whether he is becoming spent by noting whether his tail is now and then allowed to drag. The clinging snow of warm winter days not infrequently serves to weight his plumy brush so that the slight extra burden suffices to tire him out sooner than usual. Despite numerous statements to the contrary, I have several times known a fox to hole up when chased by dogs. He does not always trust to his superior speed and staying powers, nor does he seek his hole only as a last resort, for I can testify to occasional exceptions. He has a dozen assorted tricks to give his enemies the slip and unquestionably many a case of hole-up related by disgruntled hunters has been merely the result of his using a heretofore unworked trick. He will never lead you or the dogs to his den if there are young there.

He is as versatile in getting food as in escaping

the pack. He secures his food in four ways—with variations. Either he goes searching and digging for it like any razor-back hog; or he stalks it with air-toed patience; or he runs it down with a burst of lightning speed; or he plays possum and so entices over-curious or unsuspecting fowls and hares to get within darting reach. One day for half an hour at dawn I watched a fox mousing along a zig-zag pasture fence like an experienced cat. Unaware that I, hidden many rods away in a thicket, was watching him, he proceeded to lurk and loiter along the fence until at length he pounced upon a chipmunk and trotted away. A neighbor told me that she once saw Reynard catch one of her pet geese, throw its heavy body over his shoulder, and gallop off with the bird held by the neck in his teeth—a very workmanlike procedure! The reason that a fox when walking makes an almost straight line trail, all four feet in groove, is probably to reduce his trail to as narrow a compass as possible; and his tricks of running along stone walls, fallen trees, and shallow brooks make him a very ghost to track. I estimate that three times out of every four the foxes around here fool the hounds.

One of the rarest of treats is to get acquainted with a litter of young. I once had occasion to

suspect that a certain woodchucky burrow in a sugar-bush was in reality a fox den. Several times I attempted to stalk the spot and watch the little foxes at play, but never succeeded. However, one afternoon late in July, I was coming home along the edge of this sugar-bush, musing sadly upon the fact that the present tramp would as like as not be the last I would ever take thereabout, for we were soon to move to another state. As I ascended a deep and brake-bottomed ravine, I heard an odd little yelp above. Looking upward from the twilight of the cut, I beheld a beautiful spectacle. Three fox-cubs, their yellow silky coats reflecting the rich light of the sunset, stood close together on the stone wall gazing down at me far below. In a moment the mother vixen appeared beside them. For a few seconds they all stood looking into the ravine. Then the cubs with another puppyish bark jumped out of sight and the mother with them. "A tender farewell to give me, timid brothers! How could you know it was farewell?" But it was: I have never seen the spot since.

North of Saratoga, near the Adirondacks, the Federal Department of Agriculture is experimentally raising foxes as fur bearers, as well as martens and hares. The Silver and the Black Fox of subarctic regions supply the most valuable fur in the

world, but are not easily bred in captivity. So they have here been crossed with the temperate zone Red and Gray Foxes. From these crosses result larger animals not so high-strung and shy. If we American fox-hunters think we know what lithe speed and graceful beauty are, a few minutes at this station will convince us that these imported cross-foxes are lengths ahead of Reddy. Tap on the box where one is hiding, and he literally pours out through the opening into his long runway, slips like quicksilver to the farther end, tries to climb the netting, gets halfway up, glides around and down with a snaky turn, then crouches wide-eyed watching you intently! Your least move gives him a start, and you cannot in pity torture him more than a moment. You go on to the next runway and the next. Thousands of dollars worth of fur are in sight. If fair ladies *will* pine away and die for want of furs, I suppose it is a shade more humane to slaughter hand-raised creatures than wild ones. At least, I felt a glow of self-righteousness when I came away that I had not owned a gun in fifteen years!

Knee-deep in Marsh

The boggy, muddy, reedy, bushy, bubbling swamp! The treacherous, quaking waste foresworn by man, infested by unknown terrors; crawling things, darting things; ill-smelling, trackless, lonely, loathsome, stagnant, slimy!

Is that what you think it is? Is that as near as you have come to finding out for yourself? At all events many otherwise vivid and venturesome individuals do shrink (more or less unconsciously) from going down unto the marsh in boots, with a finality not unlike that which the Mediterranean world once felt about venturing into the sea beyond the Pillars of Hercules.

But what awaits you there? Wade, Look and Listen, fellow creatures of the Restless Feet and Peering Eyes! A state of Nature still prevails there, richer, more varied, more undisturbed by surrounding human occupation, than in any of the other biological life-zones except the northern wildernesses. . . . It is May 31. Suppose you draw on hip-boots, and we shall see what we shall see—and lay those ghosts of apprehension forever!

We have almost reached Thornton's Swamp,

you and I; we have resolved that we shall take all sights and sounds yonder to be our province. But, since it might add more zest and satisfy an all-too-human feeling that one should always have a Definite Object to set out for, we will say we intend to search again for that Marsh Hawk's nest. Then whatever else may befall us is grist to our mill, pure velvet, top-cream on the milk of a May day. . . .

Hank Thornton is hoeing out hills for corn planting as we pass. "Goin' sucker fishin'?"

"Nope."

"Catchin' turtles?"

"Nope."

Glancing at our hip-boots: "Trappin' mushrats?"

"Nope."

"'Sright, too late for that . . . Froggin'?"

"Nope."

Mystified, he gives it up in obvious disapproval, to resume his hoeing, and we go on across the stone wall. . . . It is a more delicate mission we are on than a Thornton could have guessed. The fact is that we are bound for this sixty-acre swamp—because we *have to go!* Is it chiefly to locate that Marsh Hawk's nest? We will be frank, now that we are so near: No! The object is not that two-by-three-feet homestead among wild-rose bushes,

sphagnum and flag. Our success cannot be measured by the fortuity of finding something tangible to fetch home. It will matter little what our hands bear at the close of the expedition. As Mohammedans make holy pilgrimages, as the Sock-eye Salmon migrate through the incredible miles of the north Pacific, as the Golden Plover visits the Antipodes, so, to some of us, there comes annually this savage urge to go, go—"something hidden, go and find it!" There comes a spring day when we, too, like the lowly Spadefoot Toad are resurrected by a secret April signal, and betake ourselves to the teeming marsh. A curious passion for living amongst the marsh creatures, watching them, feeling with them, absorbs us.

Is there not more *life* per unit of volume in marsh air, water and mud, than in any other earthly medium—even despite man's success in concentrating himself in cities? Whether we look at its water and mud through a microscope, or whether we view it as landscape, or see it with a hunter's eye, how teeming a marsh is with a various vitality! Why should it not teem? It is the ancient matrix out of which through the ages have come all the beasts of the field and fowls of the air—and man himself. The magic pitcher of the world is still exhaustless. In a swamp, life is very

real. Subsistence, struggle, reproduction, defense, disaster, delight, all have stern settings in the fastnesses of the swamp. Not a creature but lives or dies by the work and courage of his own strong heart.

As we proceed up the rise of ground overlooking Thornton's Swamp we hear deep in the marsh below a snatch of avian rag-time, Chunk-a-la-plunk, which seems to boil up from under water. The Bittern, then, is the first swamp denizen to welcome us! But first by only a moment, for with a testy squawk, a Green Heron leaves the near-by margin to flap across to a lonely clump of willows out in the wavering waste of sweet-flags. Upon alighting he stands at such stiff attention that, if we take our eyes off him a second, we cannot again detect him. We descend the hill. Two or three Wood Turtles, startled from meals of toadstools beneath the sweet fern, clumsily pretend to be furtive. Into the mud-and-water shallows we step —at last knee deep in marsh! A school of half-developed tadpoles, haunting the shallows because of certain cannibalistic traits in their elders, start down into deeper water. They are, of course, last season's tadpoles of Bullfrog and Green Frog, which require two summers for maturing. We begin to see many newly-laid egg-masses of Frog

and Hyla about, clustered among the water plants; gelatinous nebulæ, full of tiny nucleated spheres which, by as wonderful a process as that by which worlds are made, will one day soon be batrachians. Strikingly unmaternal and unpaternal are the efforts of the adult frogs to efface themselves. Like the gender of French nouns, frog-gender is by this date a nominal distinction; creatures would be hard to find which, during eleven-twelfths of the year, show less of the temperamental differences ascribed to the sexes. After May, romance goes out of their lives.

Dragon and Damsel Flies volplane, rise and land everywhere. Perhaps you have not noticed before how curiously Dragon Flies resemble miniature monoplanes. When they alight on a weed-stem the illusion vanishes; but on the wing each might be a minature Bleriot or Lindbergh. Marsh gas bubbles up at every step—but Marsh Hawks do not appear. Over our heads ever since we have begun wading are flying a score of Red-wing Blackbirds, liquidating a parental anxiety by constant repetition of their watery notes. Their nests, some with partly completed clutches of scrolled and etched French-blue eggs, some only at the scaffolding stage of construction, are frequently appearing under our noses as the water becomes

deeper. We begin to balance from clump to clump of tussock-grass, which often lurch off sideways or slowly descend under our weight. It is hot work, though we are not yet at the cat-tail and flag section of the marsh.

"There she goes!" I shout. And there she does go—with a croak. Not ten feet away a Bittern rises and flaps over the farther bushes. We wade to the spot. A high and dry flat nest on a tussock holds five odd-colored eggs as large as a Leghorn's. "Like a large olive starting to turn brown," you observe: an apter designation than the "Isabella-brown" classically applied to them and descending to us from the tale of the Spanish Princess who, as a vow, wore her chemise many, many weeks! We can see that this curious shade has its protective uses and is unlikely to be conspicuous to crows and other marauders flying above.

"And look, there's the Hawk!" Flitting nervously overhead, occasionally tumbling about like an awkward butterfly—where has she slyly risen from? The location of that oft-sought-for spot is as mysterious as ever! At a "chack, chack" from the opposite direction, we turn to confront the masculine member of the pair. Is there not here a clear case of miscegenation? When seen together the two do not seem to be of one species; the

female is larger, browner, different. Their tumbling, falling antics make it plainly evident why they were Latinized under the name Circus by the Namer-of-Names who is nameless.

We have remained quiet so many minutes that our presence has seemingly been forgotten. We hear a faint splashing off to the left. A Muskrat leisurely swims across a space of open water making for his winter home yonder, a large mound of sticks and flag-stems roofed with thatch, which has carried him through the winter as snug and dry as a Water-rat could desire. Perhaps five more lodges are within sight. Within a rod of its own home the rat dives and a row of bubbles points the way to his underwater door. We wade over. Since he has made a deep furrow in the mud leading to the entrance, we avoid following his trail. But I overlook a side entrance! With a sharp slide both feet find it—the water gurgles merrily over the tops of my boots. Scrambling forward, I draw myself up on the muskrat house on hands and knees and lifting high one booted leg after the other pour back all the water I can. In the sky overhead the chacking of the Hawks sounds irritatingly exultant. The lodge quivers with my exertions until it seems certain that any occupants must have fled in terror.

I tear off the top of the rounded pile to show

you what a snug winter home it is and we gaze into the grass-lined chamber beneath. Then we are smitten by remorse—for here is at least one conservative rat family that has kept to its quarters right into the summer. Shrinking back into one corner, her shiny, beady eyes looking straight into ours, is a mother Muskrat! From beneath her, peep a tiny twitching nose and two small pink tails. Her own rich sleek fur glints like sealskin in the dim interior which exhales the not indelicate odor of her race. As desperately courageous as a lion at bay, she has scorned the refuge of the hole through the floor because her babies could not go too. We are a brand new enemy. Except the Great Horned Owl at night, the only natural foe this animal fears is the Water Snake. One can imagine what writhing, gripping battles are sometimes fought in the darkness of their nests!

Cutting some near-by alder branches, I interlace them over the cavity and replace the disturbed thatching. High above gyrate the Hawks: it is Circus Day for all of us. Now we begin the search in earnest; plotting off the expanse of marsh, we plod up and down in parallel courses a quarter of a mile long. Occasionally the Hawks scold with increased interest; at times, dallying indifferently around a far corner of the marsh as if frog-hunt-

ing, they seem wholly unconcerned with the foolish crawling bipeds below. This play-acting gives no clew to the nest. Up and down we plod under the lusty May sun. Here, an awakened Water Snake nearly as large around as a man's wrist whips off from a mat of weeds with a sliding rasp of scaly skin. There, a Sora Rail flutters over the cat-tails, legs dangling; or another darts mouselike into the shadows. Now we hear in the distance the despairing cry of some Bullfrog, seized from the depths and dragged thither. How it pulsates, this life in the marsh; it is a stern race for a place in the sun, if only for an hour, a day!

We sit down to rest on a rockpile amid the waste. On the far-off hillside Hank Thornton stooping along in the sun is making mechanical motions with a silent hoe. As if in gentle protest against all this chatter down in the swamp, a Mourning Dove in the thicket sobs, OH! oh . . . oh . . . oh," in dying cadence. May at high noon!

A May Fly larva laboriously ascends a cat-tail stalk, pauses a moment, then—walks right out of its skin! Leaving the translucent husk a perfect mummied replica behind her, she dances a new birth in the sun. A Fly-killer cruises by, snatches a luckless Blue-bottle on the wing, and settles to devour it. A Painted Turtle pokes up an inquiring

beak to see if its basking-rock is still occupied. A sinister-looking Snapper crawls along the bottom mud seeking something living to clamp its jaws upon.

With a start, we rub our dozing eyes! Mrs. Circus Hudsonicus has just dived straight down and out of sight. We await her reappearance with frog or snake in her talons. But she does not come. Directly to the spot we splash. This time Lady Hawk butterflies gracefully up from the midst of a clump of alders we thought we had searched. . . . Six inches from the wet and mossy sphagnum which here forms the swamp floor she and her mate have built a structure of twigs and cat-tail stalks, and lined it with dried grasses. It holds four faintly bluish eggs, of a size a Bantam hen would be proud to lay. A few tufts of downy brown feathers cling to the nest-lining around them. The sitting Hawks, both of whom brood, to while away the hours of incubation, have hacked at the surrounding green stalks with their sharp beaks. Their appeals to the seekers now become piteous that we spare this treasure-house; their previous chacking quite changes and they fly within six feet of our heads. Though this nest is the final goal of three years' searching, we stay but long enough to photograph it!

We next walk to the south end of the marsh to see if the *Arethusa* and *Calopogon* Orchids are beginning to bloom above the cranberry bog . . . Buds, but no blooms yet. . . . The watchful Bartramian Sandpipers who lord it over the pasture beyond spy us and whistle mellowly down from the clouds. A Kingfisher pair is digging out a hole in the sand bluff along the brook which drains the swamp; and a Killdeer starts worrying ahead of us for fear we will come ashore and flush its mate from where she is brooding in the meadow. But we have no intention of going ashore yet. We have our collecting bottles to fill with bottom ooze and Salamander eggs—if we can locate any of the latter. Luck is with us. One jar holds two egg-masses of what are probably eggs of the Spotted Salamander, another carries Toad eggs, a third is full of the flotsam and jetsam of the ooze. At length we drag our weary and water-logged feet homeward to the infinite relief of many Blackbirds and a pair of Hawks. . . .

We have waded a marsh together, you and I; we shall be friends forever!

Getting to Know Ferns

Looking back, it seems incredible that for over ten years, the richest and the most exciting period in my own growing acquaintance with nature, *I never learned to know a single fern!* Ferns were, well, ferns. Or—just a moment—sometimes they were brakes. That is as far as I got, sleep-walking through and among and past a whole native *flora* in variety and numbers almost sufficient by itself to provide any country with an adequate botanic outlay. There they were, everywhere—I simply had not seen some hundred species of green things at all! My shame is deep upon me still, even though I have since made restitution to the fullest of my ability.

I know now that I am not alone in exhibiting this pathologic blind-spot. Such subdividing and particularizing of one's hobbies is all too common. God wot, our mental equipment and life jobs are highly specialized enough, without our pastimes being so, too. The bird-lover commonly ignores a world of flower; the botany enthusiast a world of bird-life. A geologist sees neither the woods nor the trees; and an entomologist seems somehow to

have the look of a magnifying glass forever on his face. But all with unruffled consciences overlook the Ferns—a score of species of which they may have stepped on!

How seldom do nature lovers take up Ferns! How easily ignored they are! Even an abandoned enthusiast like Frances T. Parsons could write: "To me the greatest charm the Ferns possess is that of their surroundings." . . . Exactly why are they so overlooked? I am at a loss to understand. Is it because Ferns do not blossom, and so fail to attract us in our childhood? Is it because their seemingly endless variety unconsciously discourages us from making a start? . . . They are everywhere. They are *all leaves;* they register poorly in the midsummer lush of our hardwood forests; they do not force themselves on our attention by reproductive activities as practically all other living things do. Apparently they come up in spring, reach their growth monotonously in July and are cut down by the frosts without once doing anything spectacular or interesting. Only to the casual eye do they seem thus. Once let yourself into the drama of their double-life and begin to notice their amazing diversity, and lo, you are launched upon a never-ending quest to add another Fern to your list!

Ferns are utterly dependent upon above-ground moisture for reproduction, and hence can be secured at times only by wetting one's feet. Perhaps this fact has subtly placed them in a niche apart! (Yes, *total* indifference to soaked feet is the last infirmity of the nature neophyte's progress!) No insects fertilize the germ-cells of the Fern; no birds; neither the four winds. They must grow in damp localities or where dew is heaviest. The male cell (in flowering plants, it would be a pollen grain) must *swim* to its female goal: no other need apply! Self-fertilization is the usual Fern policy, as cross-fertilization is the ingenious intrigue of nearly all flowers—each has made a survival-success of its own way.

One reads that Ferns and all flowerless plants are propagated by spores, flowering plants by seeds. How does a spore differ from a seed? A seed develops within a flower as the result of fertilization and grows into an adult; a spore is dropped from an adult (though sexless) plant and does not grow directly into a vegetative adult: another step, a different plant, lies between. The spore is not a sexual product, but a true chip of the old block, although it *develops into* a sexed plant. In Ferns this sexed plant is a tiny inconspicuous green thing, hardly ever as large as a dime, named a prothallium, a

so-called alternate generation. From a fertilization process therein results the next generation, the lusty, chlorophyll-using fern of the sun god's totem as its progenitor is of the water god's. This prothallium appears to be analogous to the seed of modern seed-bearing plants; most likely it now *is* what the seed once *was*.

For this business of producing seeds harks back to the primordial struggle between glacial and torrid seasons. The armies of these two contending seasons have swept back and forth over a terrain covering half the surface of the globe, through an age-long war in what we call geologic time. In the battle line were the skirmishing battalions of summer and winter. Non-combatants, animal and plant, had to be forever advancing or retreating, digging in or falling back, as the millennial campaigns ebbed and flowed. To the rooted plants retreat was impossible, their advance was wiped out; to the peripatetic animals it was easier. Then, cunningly to outwit the deadly snow and ice, plant refugees gradually developed nonresistent, sapless, quiescent, hibernating forms, which could lie in wait and bide their time until winter was gone. Probably these little hibernating forms were quite like the prothallium of the Fern we know to-day; the seed is a recent refinement of the original plan, for

fern-form is the oldest and simplest of all stemmed vegetation—the source of most coal. The Ferns have, like the Chinese, long ago grown weary of struggle and change—the status quo is good enough!—while the seed plants, a new race, are on the up-grade, constantly hoping, experimenting, adapting. So scornful of time are Ferns, so patient are they, that their spores may lie vital for years—even for twenty years—until warm moisture comes to them, a wait no seed could endure.

No drama in Fern life? Watch a particular Fern unfold in spring! Every stem is already there in those crozier-like, violin-headed, fuzzy buds; every frond, every pinnule of every leaf, every fruiting sporangium, every spore, in miniature perfection. As it cannot expand and bud as do trees and shrubs, all the physical structure of a Fern must be settled and packed ready to unroll. Since there are no flowers, the spore-cases grow on the *leaves*—and by these presents ye shall know them—apart. There is drama enough in searching for yet another species; a hobby as relentless and perennial as identifying the Warbler Family to its last member. You may start with seven; you will end with seventy!

The Bracken is everywhere all over the earth.

The Cinnamon Fern cannot possibly be mistaken for any other. Dainty Maidenhair, recognized at a glance, looks like nothing else. Interrupted Fern bears a spear which knows no brother. Evergreen *Polypody* and Christmas Ferns are as common as grass when you know where and what to look for. And Sensitive Fern is not so—except to an early frost—for it has neither privacy nor shrinking habits.

Sensitive Ferns and Bracken are plants of open sunny spots, the latter growing in the driest situations of all Ferns. The former puts up a fertile (sporangia-bearing) frond-stalk which looks totally unlike the non-fertile fronds. In the Bracken both fronds are similar, the ones bearing sporangia showing them near the tips.

Polypody, dweller on moss-covered ledges, bowlders and rotting logs, remains green in winter, as does Christmas Fern which is a ground-dweller of the woods. The fruiting and non-fruiting fronds of *Polypody* are similar, while Christmas fronds differ somewhat, the fertile having more *pointed* tips.

In Sensitive and Cinnamon Ferns the fruiting fronds are tall and stalk-like; the former topped with an orange mass which appears well before the

graceful leaves unroll around it, the latter by green masses which soon turn black.

Maidenhair almost everyone knows—if he does not confuse it with Meadow Rue because the two bear leaves somewhat resembling each other. Like Bracken, Maidenhair comes up in *single* stems, but there is no other similarity, one is as dainty as the other is lusty and coarse. It prefers rich soils in deep shade. Its feathery fruiting and sterile fronds are nearly alike, the leaf ends *curling over* to protect the sporangia.

Since the fronds of Interrupted Fern are obviously interrupted by the shrunken abortive-looking fertile leaf-pinnules, no other hint is needed to apprehend it.

It is doubtful if a simpler system of identification for beginners could be devised than Mrs. Parsons offered, back in 1899, in *How to Know the Ferns*, but there is as yet no book on "How to Want to Know the Ferns!"

Mushrooms or Toadstools?

THERE is a fixed idea current among those who have never actually looked into the question of distinguishing poisonous from edible fungi that the former are toadstools, the latter mushrooms. But neither term has a meaning for the initiate. Several kinds of food fungi are not of stool shape at all. As a matter of fact, there are but three or four varieties of fungus whose appearance might be attractive to the greenhorn, which are deadly—despite general belief to the contrary. The fungi suffer in reputation as do snakes from the tendency of over-cautious human beings to regard most fungi and reptiles as *poison* unless they are well-known to be harmless. It is easier for the beginner to learn how to identify the non-edible few than the innocent many. Now and then a fungus, while not truly poisonous, may cause nausea or other mildly unpleasant symptoms if eaten; but these varieties are almost invariably of such bitter flavor as not to be relished. Further, some kinds are not palatable even though quite innocent of harm.

For the benefit of those who may desire to master some safe rules for collecting fungi for eat-

ing purposes, and not for the nature lover's gratification of getting familiar enough with them to call them by their first names, we can set down a few broad generalizations. Every rule that can be formulated will disbar one or several kinds which are harmless and delicious. However, it is better to stay alive and miss a few tid-bits than to fail to know and observe certain wise precautions.

1. Eat no mushroom-shaped fungi whose stalks grow out of a well-formed cup or sac in the soil, or have a flecked or scaly covering for cap or stalk.

2. Avoid milky-juiced mushrooms, unless the juice is reddish.

3. Beware of shiny- or thin-capped varieties, or those brightly colored.

4. Do not use any which have begun to grow old. When ageing, they are apt to turn brownish or yellowish. Most fungi, sometimes even when quite young, contain the eggs or tiny moving larvæ of various flies. When old, they are almost invariably thus infested and hence are not fit to eat.

5. Avoid fungi while in the button stage, that is, while just pushing up through the ground, and before the distinctive marks and colors become clearly visible. One small button of the Deadly Amanita might cause death if eaten.

After all, as the State Botanist of New York

puts it (Official Report, 1895), "The only safe and *reasonable* way to separate the good from the bad is to learn to recognize each species by its own specific characters. It is in this way we recognize the useful and esculent species among flowering plants . . ."

All the deadly species in the United States belong to the genus Amanita and one, *Amanita Phalloides,* is "probably responsible for a vast majority of the fatal accidents resulting from 'mushroom poisoning,'" to quote the State Botanist again. Just as there are certain persons who cannot eat eggs, cheese, or strawberries without a digestive disturbance because of individual idiosyncrasy (as it is soundingly called); so some individuals may be made ill by perfectly harmless mushrooms. And as edible fungi have a heavy protein content (twenty per cent to fifty per cent of their dry weight) overeating of them is quite as apt to upset the stomach as a heavy meal of meat.

The Deadly or Poison Amanita is very neat and attractive in appearance, and it is variable in the color of the cap, but only a careless observer would be likely to confuse it with any other species. It possesses no unpleasant taste or odor. The cap is destitute of warts, and varies in color from white to dark smoky brown. Most commonly it is white

or a very pale greenish yellow. The gills are white; the bulb at the base of the stalk is broad and distinct, and one to one and a half inches across. It is a large, showy thing, with a cap three to five inches wide, and usually with a collar standing out on the middle of the stem. It is common in woods, groves and bushy pastures from July to October.

The Fly Amanita has a cap adorned with numerous white or yellowish warts. In the younger specimens the cap is bright-red, scarlet or orange, fading sometimes to yellow on the *margin* in the mature plant. The cup or bulb at the base is not broad and abrupt, as it is in the foregoing species, but gradually narrows into the stem in a somewhat ovate form. The stem bears a collar. It runs larger than the other Amanitæ, and may sometimes be found a month earlier. Flies who have sipped its juice may often be seen dead on it and beneath it.

Most persons are introduced to edible fungi by eating mushrooms from the grocery. Hence the shape of the Common or Garden Mushroom is naturally the first one sought out-of-doors. But there are at least six delicious fungi of quite different appearance. Morels (see page 33), Puff-balls, Coral Fungi, and the Boletus, Beefsteak and Oyster Mushrooms, should on no account be missed. We have no purpose here to describe either

them or such staple dainties as the Fairy Ring, Coprinus, Agaricus and Chantarelle, for many reference books have already completed that task.

I have found it much the better way when picking fungi to clean them as they are collected. Jumbling them together in a bag or box on the way home invariably crumbles them and mixes any dirt clinging to the stalks, or debris on the caps, all through the lot, and makes preparing them for cooking a tedious job. Care in picking will often make it necessary to do but little trimming and peeling to make them ready for the stove. One's booty should invariably be cooked on the day collected, unless one desires to dry them—as one often does with the Fairy Ring and Agaricus, for instance. It is better to keep them in the ice-box in a cooked state than raw. In picking them, notice any havoc which fly larvæ may have done. Breaking the stem across and the cap into one or two sectors, will usually be sufficient to reveal whether the mushroom should be kept or not. Unless somewhat badly galleried by grubs, large areas can often be saved. Stems of the tall varieties are usually too hard to be boiled tender and need not be kept.

Frying in butter, taking care not to hurry the process by too hot a fire, is a fine way to prepare most fungi. But do not cook them too long! To dry

them for future use it is best to set them just out of the hot sun in a place where there is a current of air, and allow them to become thoroughly dried at one standing.

Mushrooming (except for Morels) is a late summer and fall process, and one not to be undertaken too lightly. Perhaps only experience and enthusiasm will teach one where certain kinds should be looked for and others not. The writer has always found it a baffling thing that two seemingly identical environments will not grow the same kinds of fungi.

'Possums Are Getting Common

RECENTLY it has appeared that almost anyone liking to make strange pets can own his own 'Possum —even away north of the Mason-Dixon Line. The comparative security attained by Brer 'Possum is no safeguard against man. Quite the contrary. Except that he fares forth only by night, he is the easiest of prey to our dogs and guns, the easiest for a nature-lover to catch. The rank odor the soft little creature exudes probably makes it unpalatable to all the wild slayers. Its habit of "playing dead" was not developed from fear of man. The odor of its limp body must always have sufficed to turn wolf, fox and catamount away from it in disgust; otherwise the only marsupial in North America would not have survived down to this Modern Coal Age. Now the vogue for fur at all costs may shortly wipe Opossums from the earth. In Westchester County, N. Y. (which the realtors have named "A County of Homes"), during 1925-26, over five hundred were trapped or shot! Just when they were getting such a good start east of the Hudson too. For it was only about thirty years back that they had crossed the river at

all. About 1897 John Burroughs—living on the west bank of the Hudson—wrote as follows:

"A new track has appeared upon the snow in my neighborhood here on the Hudson within the past few years. It is a strange track, and suggests some small, deformed human hand. If the dwarfs or brownies we read of in childhood were to walk abroad in winter, they might leave such an imprint behind them as this.

This track, which we seldom see later than December, is made by the Opossum. The animal is evidently multiplying in the land, and is extending its range northward. Ten years ago they were rarely found here, and now they are very common. I hear that they are abundant and troublesome on parts of Long Island. The hind foot of the Opossum has a sort of thumb that opposes the other toes, and it is the imprint of this member that looks so strange. The under side of the foot is as naked as the human hand, and this adds to the novel look of the track in the snow."

Mr. Burroughs elsewhere speaks of seeing sixteen young from one litter. I believe this to be a record for any mammal in America! The Opossum's fecundity partly explains why they are—or were—on the increase. In the Order *Mammalia*, the *Marsupials* come first, as the most rudimentary or primitive family. The female Opossum, as is characteristic of all *Marsupials*, can give birth to such an astonishing litter because they are born prematurely, so to speak. At birth they are so small and helpless, no larger than new-born mice! that

they must be carried in the mother's stomach-pouch and be suckled there, for nearly two months before they can even walk. And thereafter, for another month at least, they cling by their tails to hers or by their claws to her fur, so that the mother, when she goes foraging, does not need to herd them along to safety or hide them from enemies. Opossums have been found carrying *two litters*—one in the pouch and one on the back!

One night last fall a 'Possum strolled across the road just in front of me. It was headed straight for two little houses near-by where some negro neighbors lived—a most unsafe locality for a 'Possum to be in! Having a certain past respect for her tiny sharp teeth, I caught her by the ratlike tail and thus carried her home. Of course she played dead at once—and how perfect an actor! She, I say, for she bore on her belly that fur-lined pocketbook. One's fingers could explore the pouch to the bottom. It being fall, she carried no small change. After a few days, beguiled by figs, bread, apple-cores and raisins, she lost something of her fear and would allow us to hold and stroke her like a kitten, exhibiting the most comical humility; now and then letting out a soft whine irresistibly funny in its peevishness. Another sound she made when somewhat irritated was—as Burroughs has said—"like scratching matches on the floor." Nights she

would crawl from the box in the cellar where she slept through the day, to be discovered at length next morning in some impossible nook up among the beams or behind stacks of odds and ends. We could not induce her to bite, until a little boy, playfully holding his finger between her teeth, finally did cause her to close them together, slowly, reproachfully, but so firmly that when they were pried off, a badly punctured fingertip was disclosed. That evening we liberated our Australian-style pet and saw her crawl slowly off for the woods, abruptly stopping once on the lawn to devour an apple-core.

In semi-cultivated areas east of the Alleghenies Opossums are nearly as common as Skunks. My eager-nosed dog often smells them out in crevices in rocks, and I have occasionally seen them dozing in a sunny crotch during the daytime. In the evening they are absurdly easy to catch once your dog has got on a trail. Their soft fur is like a kitten's and, after a few days of kindness, they lie in your arms as unobjectingly as an old tabby. Beyond this attraction they have not much to offer as pets except to play dead whenever anything out of the usual happens. Then the lips draw back from the jaws in a disgusting leer, the eyes stare and seem set in rigor mortis, and they are absolutely no fun until they finally come to again.

Hidden in the Air

It is a seven years' wonder that the air nowadays is shot through and through with radio waves; that even the atmosphere of your quiet chamber is a tempest-tossed sea whose wild waves are saying—what are they not saying—if you but had ears to hear! Beyond microscope and spectroscope, beyond the power of anything except the magic radio-tube or crystal-detector, vibrate a million messages. And, yet, vital to humanity as are some of these messages, there is much else in the "empty" air which is living too, as invisible without science's help as the ether waves, and even more significant to our well-being.

A brief census of the transparent air shows how full of vitality Nature has packed the world. Is air as empty as it looks? Bacteria are but one of the elements of this aerial host that dwell "Beyond the Horizon." Bacteria are like electrons of atoms—one or two or twenty cannot be seen, but when a crowd of them gathers, then you can detect that something is going on. It takes more than four-score-and-ten of even the mightiest of "germs" to be visible to the unaided eye.

Pollen is likewise always "on the air"—in summer. We speak of outdoor air, far from chimney and highway, as pure. That may be partly true in mid-winter; it certainly is not true in warmer weather. In June particularly there are times when myriads of grass and pine pollen are being lavishly tossed upon the breeze. By sitting quietly facing a dark object or looking into the shade, you can see that the air seems to be bearing a moving current of dust. Steadily, without eddy or variation in quantity, it sweeps along, its motes so fine that a strong effort of eyesight and just the right lighting conditions are necessary for you to detect it. No wonder every flower stigma is fertilized by this blizzard of fructification! Spread a thin film of cedar oil or balsam upon a clean pane of glass, and hold it athwart this drift a minute or two. Then turn it face down in sunshine until dry and study your catch under the microscope. I have caught ten varieties of pollen grains thus upon a single plate: of course those from plants depending for pollination upon winds rather than upon insects. At times when Orchard Grass is just ready for pollination, a sudden breeze sweeping across a field will raise clouds which look exactly like a thin smoke. About this time, too, a walk through a growth of Scrub or Jack Pine will drench your

clothing with yellow pollen from the little male cones. But pollen also is only one of the living elements in a summer atmosphere—and of course its nature is nothing like that of bacteria.

Yeast is an invisible microcosm (a plant, not a bacterium) in everyday air everywhere. Alcoholic fermentation cannot take place unless yeast plants fall into a sweetened liquid and start splitting sugar atoms into carbon dioxide gas and alcohol. Yeast was surely not intended to make grape juice into wine or apple sap into cider; yet curiously enough, like the bootlegger, it is always with us. We are forever breathing yeast, unknowingly brushing it from our clothes, washing it from our hair and hands. Let an innocent fruit juice stand for a few minutes in the open and a score of yeast plant sections will have fallen into it—and presently it will have become a subject for litigation!

Not only is the "crystal clear" air of a spring day laden with pollen grains and yeast plants and with dust—a minute earthly debris from a thousand sources, but it is quite as rife with mold spores and bacteria. As everyone has observed, mold forms on almost everything which becomes damp for even a short time: hatbands, books, shoes, cheese, bread, meats, linen or wearing apparel put away undried (for mildew is a mold growth), fruit skins, cellar

walls. Since they are not green plants and capable of making food by sun-power, but saprophytes subsisting upon juices ready-made for them; molds can absorb food only where some moisture exists, no matter how little. Molds spring into view as by magic and in very wide variety. But the magic really lies in their infinitely tiny spores which everywhere, invisibly yet sufficiently, dust down upon places just and unjust toward their growth. Take bread mold, the kind you see on unhurried bread and deferred cheese. Did you know that it is a flower? It is—in a way. We can scarcely notice the mold plant until it blossoms. Under the low-power of the microscope it affords as rich a display as a bouquet of orchids might furnish, if they were done in black and white instead of in color. The mold plant proper takes root and spreads a large mass of fine filaments deep into its soil long before it is ready to send flowering stalks toward the light and air. By explosions of these fruiting-heads, the seeds—invisible spores even smaller than pollen—are shed into the air in such numberless amounts that you cannot expose a disk of warm gelatine anywhere for two minutes without a dozen taking root and sprouting on this Lilliputian garden plot.

The magnificent Chestnut tree, of such real

value to man, began to succumb about twenty years ago near New York City to the insidious, under-bark attacks of a mold-like fungus accidentally imported from Japan. Now every Chestnut in America appears doomed, for the wind carries the tiny spores miles every year. How true here that "there is no great and no small to the Great Soul which knoweth all!"

Lilac leaves turn black and wither during damp years because the vegetative threads of mold choke the veinlets of the lilac whenever a spore of a certain fungus can find a spot to enter the leaf. Blackberry leaves often exhibit on their undersides a bright orange fungus implanted there by the clear zephyrs of spring.

While molds and fungi are many-celled, with differentiated parts for vegetative and reproductive purposes, (degenerated green-plants, probably) bacteria remain individual; existing in colonies but not colonial. Each is for itself whether in peace or war, life or death (to its host) wherever they find themselves dwelling. To demonstrate the presence of bacteria here, there and yon, is a simple process. Get from your pharmacist four ounces of prepared agar-agar solution such as he dispenses to doctors and boards of health. This is a culture medium to

grow bacteria in. Since there is no practical substitute for them, procure a half-dozen Petri dishes—thin round glass boxes the covers of which telescope neatly over their tops. Sterilize these by a half-hour's immersion in steam, drain them bottom-up and then telescope them together to await use.

After placing the druggist's bottle of agar-agar in warm water to melt its contents, pour quickly into each Petri dish enough to cover the bottom. Shut the covers and re-plug the bottle *at once* to keep out germs from the air. When cooled, the dishes are ready for action. Keep one dish unused, as a check or control on your results with the others. Now remove the cover from a Petri dish and expose it for five minutes anywhere your fancy dictates: in the home, in the woods, cellar, school, or city street. Let a fly walk across one. Test your favorite drinking-water. Or a fleck of pus from a finger-cut. Put a drop of raw milk, one of boiled, and one of pasteurized, on a dish-bottom of culture-medium. But first dilute the milk by ten parts of *sterile* water, so full is milk of germs; even the best of it! Many experiments will suggest themselves. Few of the countless bacteria in air, soil and water are *disease-germs;* many are absolutely

necessary to human enjoyment—indeed to life itself. Butter, sauerkraut, cheese, were impossible without them.

After three or four days in a cool room with subdued light the covered dishes will exhibit bacteria, yeast and mold colonies of a size large enough to see. Molds and yeasts if allowed to continue growing for a week will, through their colorings, exhibit themselves unmistakably. Some bacteria double their number every half hour: if you are good at mathematics, you can readily see what multitudes can accumulate in three days. (Do not uncover the dishes at first, but study them through the glass top.)

Wherever one or more bacteria have landed, a tiny round area, not larger than a pin head, will reveal their multiplication. The spots will vary in color and appearance. Mold spots are usually green, gray or black; yeasts, yellowish; bacteria colonies, of every aspect—too numerous to describe here. Their number and arrangement often reveal as interesting things as do animal tracks in the snow.

Of course, a microscope quite logically comes into play at this point, although, for bacteria, practiced and expert manipulation and a knowledge of slide staining are required. Much can be learned

without the microscope, however, by using a strong magnifying glass.

The procedure of isolating a particular colony of any organism as done by experts, is simply to transfer by means of a sterile pin-point a bit of the mass into a test-tube holding agar-agar solution and properly plugged and sterilized. The test-tube affords space in which the single variety of bacteria or mold so grown can develop in larger quantity.

Your Petri dishes can be used again and again if you take care to steam them until they are again sterile. Should your interest lead you further, there are non-technical books on bacteriology to be had from which with the aid of a microscope you can make in your own home quite a satisfactory study of germ life.

Policeman Kingbird

THOUGH we may become "tired of kings" (as did Emerson) we shall still find the Kingbird of interest. For this eight-inch bird, although without either size or majesty, merits his name by his pugnacious, crusading disposition. We shall never know who first named our common birds, more's the pity; neither shall we be able to rectify their crude mistakes. Their moving fingers have writ and moved on, leaving ornithological nomenclature replete with inappropriate christenings which we cannot alter. Here in the Kingbird we have one of those ancient misnomers. If policemen had at that remote naming-time attained the prominence they now enjoy in our community life, perhaps instead of being known by its present royal appellation the Kingbird would have been called the "Police bird." The Latinists have improved the matter somewhat by officially classifying him as "*Tyrannus tyrannus*"—which title, while rather overemphasizing the bird's disposition, gets away from the regal implication. Of course, the blue, brook-haunting Kingfisher is not to be confused

with the royal house of Flycatcherdom, though their titles are suggestively similar.

Even if Kingbirds are such common inhabitants of orchards throughout America, that all birders know them, many of their characteristics are peculiar and individualistic enough to repay repeated observation. Typically, one sits on a tip-top twig in an orchard—whether master or matron we can only guess, for the twain are as like as two mosquitoes—keeping sharp eyes out for any flying thing in its neighborhood. If an insect appears, this representative of the flycatcher clan bolts at it, snaps it with his bill and perhaps with a snicker of shrill notes returns and settles back on its perch before the insect has fairly reached its crop.

The Kingbird often has been accused of improving the shining hours by catching bees near the hive colonies. Popular opinion is still divided as to the possibility of any bird's swallowing a red-hot worker-bee and coming back for more; but it has been authoritatively asserted that the Kingbird selects only stingless drones as its prey. Since there is always a superfluity of drones, this avocation of the Kingbird is a harmless one. At any rate, the locally applied name, "Bee Martin," has properly fallen into general disuse.

But should a crow or hawk casually pass over

his perch, Policeman Kingbird's ire is at once aroused. Off he goes pell-mell like a traffic-cop after a speeding Ford, bickering and chattering at a great rate; and proceeds to treat the casual passer-by as a designing marauder, willfully and premeditatively intent on dire deeds to himself or his establishment. Flying over, under and all about his harassed quarry, who is seeking cover as fast as possible, he spitefully attacks him upon every side, working himself the while into a very frenzy of abusive language. His lifelong training in aerial acrobatics now comes into good play; tumbling, pitching, sideslipping, he tweaks and pecks the back and head of his prey so belligerently that soon he is sole master of the air again, his fancied assailant put to rout. Then back he comes chinkling and sputtering himself into a frame of mind meet for his perch. Nor is it only the bigger birds that he thus chases, but also the accidental visitor of his own size. He means to be cock of the walk while nesting operations are going on. And this exclusiveness stays with him always; he never flocks with his kind nor associates with other species, spring, winter or fall.

The Kingbird's nest is an artistic affair; not neatly turned or highly finished; but deep and well-proportioned, and usually ornamented with white or gray scraps worked into the outside. Bits

of newspaper, dried stalks of the Paintbrush Hawkweed, tufts of cotton waste or wool, are often thus employed. Whenever they nest in a tree, they choose a horizontal branch and one likely enough having no shade above it—hence on hot days only their wings can serve to fend off the sun from the nestlings, and they may often be seen standing on the rim and acting as parasols. But they do not always choose a tree. I have found them nesting blithely on top of a fencepost in a pasture, and upon the elevated frame-work of a windmill. Another curious site I shall not forget was that of a nest built upon a bare, twisted, gnarled tree-root projecting horizontally some five feet from a steep bank, and extending but eight inches above the surface of a creek. Jauntily making use of this wrist-thick root, the pair did its homesteading a mere handsbreadth over a swirling stream.

A wide variety of markings characterize the Kingbird's eggs. The ground-color is creamy white in all cases and the spotting a rich chocolate. The variation results from the size of the spots and their arrangement; sometimes their confluency is extremely beautiful and bizarre. Common though they are, the Kingbird's clutch of four eggs is always worth glancing at because, occasionally they achieve the utmost in birds' egg art.

Fishless Aquariums

THE parsimony of language is such that the word "aquarium" is commonly applied to those sparklingly clear, sunken-castle-sporting, globular bowls, in which two sterile goldfish, serving a life sentence for the crime of being beautiful, wearily float out their decorative days. But to the amateur naturalist the aquarium worthy the name is any water-tight container (preferably glass-sided) stored with native aquatic life of rich and ever-changing interest, which he has collected himself. Such aquariums are far more personal, more natural, more vital. How can going to a city shop and buying a few twenty-five cent goldfish and a strip of water plant, compare with the process of stocking your own aquarium from a neighboring brook, adding to it, keeping watch on its unfolding life-processes?

Fish with their wide range of movement are mere prisoners in the small aquarium, but there are scores of other water denizens who will be quite content within its confines, and can pass through their whole existence-cycle almost as well there as out of doors. Fish also prey on nearly all of the

smaller water creatures, and so make poor companions for them in captivity. Suppose you leave out fish from at least one of your home aquariums.

A good aquarium needs a large top-surface for a maximum absorption of air and admission of light, hence it is better to discard the globe-shaped affairs (which, furthermore, distort one's view of their contents) and use those having square sides. A little experience will show that, with the exception of a few aquatic creatures requiring running water (crayfish, for instance), your pond and brook-stocked cage of glass will suffice to keep alive indefinitely almost any aquatic thing you may find to put into it. Frog, Toad, Salamander and Newt in this observatory of yours will progress from eggs to legs; Dragon Fly and Caddis larvæ will attain their majority; Snails will lay fertile ova masses along the glass; Mosquito wrigglers can be raised to adulthood; tiny Cyclops will go on life-cycling unmindful of man, and so will Asellus and fresh-water Shrimps; the astonishing Water Spider will spin its submarine net . . . These are but a few of the spoils you can bring back with you from a morning walk by a pond side or brook.

A strong, wide, handled-sieve, such as you can buy at the five and ten cent store, serves perfectly as a dredge if you wade into the depths of a pond

or work from the banks of a brook. If you wish to use a long-handled net, it is not difficult to make one * from bobbinet, strong wire and a bamboo pole. This will increase your range but cannot be used so vigorously along the bottom, though it will "double" in serving as a butterfly net. A Mason jar, with a soft wire fixed as a carrying handle about the top, will enable you to carry home your spoils in good condition.

In storing your aquarium you must include a waterplant or two to maintain the oxygen content of the animal life and to furnish needed food. Many suitable varieties of plants will be found wherever your dredging is done. You must also take care to keep the aquarium out of direct sunlight, otherwise it will tend to grow *algæ* and *spirogyra* so fast as to become opaque.

Go forth as early as spring will let you. The Salamander and Hylas will probably have already laid their eggs—masses of clear jelly as large as your fist, holding the round eggs within; later the various Frogs will contribute; and lastly the Toad. These will be found in deeper parts of swamp pools, never in running water. In every pool of still and muddy depths you can find the fat last year's tadpoles of the Bull- and Green-frog, for

* See page 263.

they require two summers to complete their metamorphosis. In gathering these spectacular finds you may at first imagine that you have brought up nothing else. But look sharply! If you do not have twenty other visible treasures, besides countless microscopic life-bits, your catch will be exceptional.

All that a scoopful of pond water and mud may hold on the earliest of spring days cannot possibly be described here or even fully enumerated. The few names given below will make it possible for you to go to the reference books for first aid. All of these are common, and the list includes representatives of several of the great orders on the tree of Animal Life:

Amœba (microscopic)
Asellus
Back Swimmer Beetle (*Notonecta*)
Belostoma
Caddis
Cricket Frog
Cyclops
Cypris
Daphnia
Diatom (microscopic)
Diving Beetle (*Dytiscus*)
Dobson Fly
Gammarus
Hydra (nearly microscopic)
Hyla (2 varieties)
Leech

May Fly
Newt
Paramœcium (microscopic)
Salamander (2 varieties)
Swamp Snail (and others)
Stone Fly (*Perla*)
Vorticella (microscopic)
Water Boatman
Water Scorpion (*Ranatra*)
Water Spider (*Argyroneta*)
Water Strider
Whirligig Beetle

Kings, Queen and Mimes

Observation of insect life provides plenty of drama. It were mystery enough to try to account for the customs of the bee hive. The Honey Bee workers, born in May, who never live to see winter come, yet bend all their energies, working themselves literally to death, to lay up winter stores for the hive; these *neuter* workers, who somehow know that male drones must be provided through their feeding skill for their new Queens to mate with; these spinsters, who understand just how baby bees should be fed and reared—all these customs confound behavioristic Watson and all his school.

Baffling enough—yet the Monarch Butterfly puts some posers, too. A *migrating* butterfly, this, the only one, so far as I can learn. It goes south in early fall but returns north in spring laying eggs on tender young Milkweeds as they come—and then dies. The spring young carry the invasion further and further north, until some of the breed actually reach the shores of Hudson Bay! Each season the final generation, after having developed from egg to larva and chrysalis to imago adult, at

last in the autumn goes south too. Always south, unguided by a single veteran traveler to show the way. Strange! Yet stranger is the recent discovery that they use certain *fairly well-defined routes!* Not one hibernates in chrysalis or cocoon. Migrate or die, is their slogan. They gather in flocks as birds do, and leisurely work their way beyond frosts, traveling in great companies which are a marvel to behold. They fear no bird enemies, either as caterpillars or adults, which is a great advantage to any species of insect. Why? Because their odor or taste, or both, is so objectionable to birds—and animals—that they are immune as prey.

The Monarch is a king of beauty and has a manner all its own in each of its life-stages. Both carried by man's ships and blown far astray by the winds, it has spread in recent years to all lands on earth. In my readers' behalf I can do no better than quote Anna Botsford Comstock on this subject:

"Its caterpillar is a striking object. Milkweed is succulent food and the caterpillar may mature in eleven days; it is a gay creature, with ground color of green and cross-stripes of yellow and black. On top of the second segment, back of the head, are two long, slender, whiplash-like organs, and on the seventh segment is a similar pair. When frightened, the

whiplashes at the front twitch excitedly; when it walks, they move back and forth. These filaments are undoubtedly of use in frightening away the little parasitic flies whose grubs, hatching upon its back would . . . bring about its death.

I remember the creepy feeling with which, as a child, I used to behold them waving and lashing their whips back and forth after I had disturbed them . . .

The Monarch chrysalis is, I maintain, the most beautiful gem in Nature's jewel casket; it is an oblong jewel of jade, darker at the upper end and shading to the most exquisite whitish green below. Outlining this lower paler portion are shining flecks of gold . . . like bits of polished gold-foil. There may be other gold dots also, and outlining the apex of the jewel, is a band of gold with a dotted lower edge of jet; and the knob at the top to which the silk which suspends the chrysalis is fastened, is also jet. The chrysalis changes to a darker blue-green after two days and black dots appear in the gold garniture. As this chrysalis is usually hung to the under side of a fence-rail or overhanging rock, or to a leaf, it is surrounded by green vegetation, so that its green color protects it from prying eyes."

The "Viceroy" Butterfly understudies the Monarch, though it is classed in a totally unrelated genus. It is difficult for entomologists to tell them apart at a distance; birds do not try. Evidently the Monarch took the part first and in the fullness of its run on the stage of time, developed an odor, or body taste (or both), which now makes it singularly distasteful as food. And the Viceroy, although it has no such crude protection, subtly makes-up to pass for the other, and is as severely let alone. Ex-

periments have been made by feeding these two insects to monkeys. The animals will at once discard both the ill-favored one and the imitation. But if the wings of the Viceroy are removed, it is eaten without hesitation and with relish.

The only other butterfly closely related to the Monarch has been named "The Queen." She (or they) is likewise let alone by birds, for a similar reason. The Queen's habits are similar to the Monarch's except that they do not migrate, and rarely appear above Florida. This southern butterfly likewise has a shadow, a double, a copy-cat, belonging to a completely unrelated genus; but the imitation, the "Vice-reine," is not quite so delicately done.

Both Monarch and Queen affect only the Milkweed family. The males of both have a conspicuous scent-pocket in the center of the lower wings, probably for the attraction of mates. The two appear to have but four legs (instead of the usual insect six) as the front pair have become so rudimentary as to be unfit for walking.

And, speaking of mimicry,—not merely resemblance to *surroundings*—what uncannily clever character-parts are played by certain insects! "Be yourself—be natural!" we are forever being told, as though there were no hypocrisy, no pretence, in Nature. But there is!

There is, for example, a Moth (*Sesia apiformis*) which so exactly resembles a Hornet that, unless closely examined, it might readily be mistaken by the most observant. And another, the Bee Hawk-moth, is a wonderful mimic of the Golden Bumble-bees which frequent the same flowers. If disturbed, these act exactly like the Bees, giving off the familiar bee odor and even pretending to sting, though they have no stinging mechanism. There are several varieties of true Flies which are parasitic in the nests of Wasps, but get by unrecognized as intruders because they have made themselves look so like their hosts. Scientists who have studied African species have recently reported that the African Swallowtail Butterfly offers another puzzle. The males have long graceful tails, but their mates have no such appendage, and are so different in form and coloration as to *mimic* a totally distinct species to perfection. But this is not all: the aforesaid male, throughout a wide range, remains himself; although the female assumes three different forms each of which imitates distinct species of butterfly! How Darwin would have liked this one!

In your rambles you will likely enough come upon the caterpillar of the common Tiger Swallowtail, as its range is America at large, and its

menu cosmopolitan. It has the curious habit of "making at first a silken rug on the leaf where it rests when not feeding." When the caterpillar is fully grown it elaborates this mattress until finally it "wraps the draperies of its couch about it and lies down to pleasant dreams" for its final chrysalis sleep. One of these caterpillars before its complete retirement is, to me, a singularly creepy object. It has false eye-spots on top of its thorax, conspicuous, yellow, gleaming; in front of which, when startled, it darts out its red, forked scent-organ as a snake darts its forked tongue. Although usually but two and a half inches long, it is a thick green worm whose plumpness culminates in two fat-ringed segments just back of the head where the eye-spots are. When it humps its head underneath these segments, projects its tongue-like organ, and sways its front end back and forth suggestively, it makes a peculiarly vivid impression. Apparently this caterpillar tries to pass for a snake—and a nasty little one, at that. But how in the world could a butterfly become familiar with a bird's fear of snakes; as a caterpillar, mind you, not as a winged, sophisticated adult that had flown about and learned something of the world! No less an authority than John Comstock insists that this set of actions is performed merely to scare off hovering

Ichneumon-flies which might lay death-dealing eggs upon it, but on two occasions I have seen a bird take a good long look at one of these caterpillars as if in startled fear—and leave it severely alone. This forebearance may have been due to the smell emitted by the scent-organ alone, but the bird's attitude had all the appearance of fear.

Tiger Swallowtail exhibits two phases just as Woodchuck, Screech Owl, and Gray Squirrel do. But the varying one, not the yellow phase most commonly seen, is said always to be a female, while the male always appears tiger-fashion. A black-phase female has been known to lay eggs from which both phases emerged. I have seen the black-phased female but once, and the books say that she rarely appears north of Mason-Dixon Line—below which color questions are most vexing. This peculiarity suggests its aforesaid distant relative's erratic variation in Africa—another Afro-American race problem to be solved!

"Now You Tell One!"

MANY nature humbugs are astonishingly widespread and universal especially among children. How they are handed down (even to children in cities) so positively, and how they persist even in the face of ready disproof, have always been a wonder and a mystery to me. Here are some of the commoner ones:

1. That the handling of toads will produce warts. (No foundation whatever.)
2. That "horsehair snakes" can be created, *de novo*, by bottling up a horsehair in water and allowing it to stand six weeks.
3. That snakes are dangerous, and are to be killed on every occasion. There are but three venomous snakes in eastern America and—except for certain mountainous, rocky sections and possibly two or three dense swamps—none of these are north and east of the Alleghenies. Snakes, except for the Blacksnake, probably do more good to agriculture and wild life than harm. The common Watersnake is very likely to be called the Water Moccasin and as such believed

to exist everywhere. But that is untrue, since the Moccasin is extremely rare north of Washington, whereas innocent Water-snakes are abundant.

4. That the Hog-nosed Snake, or Puff Adder, is poisonous and a fighter. This snake is the biggest bluffer in snakedom, but cannot be induced actually to bite you. He will puff up, hiss and coil, and act ever so aggressive—until you do a little aggression yourself. Then, as like as not, after being handled he will "play 'possum" for you.
5. That nesting birds desert handled eggs. I know of only two instances in my experience where this seemed to be so, but could not be positive that approaching the nest or touching the eggs had anything to do with the bird's desertion of it—because parent birds are often killed or scared from the vicinity by cats, weasels or other terrors. This fiction is quite universally discountenanced by ornithologists.
6. That bats are birds and that they will fly into one's hair if he (or she) doesn't wear a hat. Probably this one was originally invented to scare children into wearing a head-covering after dark.

7. That weeds are not plants, or that there is an essential difference between weeds and plants. This, of course, betokens complete ignorance of botany.
8. That all "germs" are harmful. Disease-producing bacteria are few in number among the thousands of varieties now known. The elaborate attempts many people make to avoid germs, and to eat, breathe, or handle nothing which is not aseptic, are equally amusing and exasperating. (This tradition has proven very remunerative to American advertisers.)
9. That little toads sometimes rain down from the clouds, and that this accounts for the great numbers one sometimes encounters on summer days. These floods of tiny hopping-toads and frogs, are caused by the drying up of their home pond, thus forcing them into a rapid metamorphosis and later to a complete abandonment of the spot. Sometimes in such circumstances a whole region will appear to be alive with them making it almost impossible to step without treading on one. They soon distribute themselves to the four quarters of the compass, although their mortality on the way must be enormous.

10. That cats are harmless, lovable animals, gentle, artless and lazy. Well, some cats may be in towns and in the daytime. But pussy is by nature a night animal and her daylight habits are deceptive. In the country she is a terror to wild birds, chipmunks, baby rabbits and squirrels, as well as rats and mice, no matter what a cozy, stretchy, cuddly bunch of fur she may be in the house.

11. That vegetables and fruits are essentially different; this I find is usually a puzzle to children. In fact no such sharp line can be drawn, except that fruits have "acid" juice. Both, botanically, are fruits; a fruit being any receptacle or cover for seeds. A coconut is a fruit; so is a pea-pod. A potato is a plant stem, as are asparagus and rutabaga "turnip." Brussells sprouts, cabbage, and rhubarb are leaf products. Cucumbers are called vegetables, while their first cousin, melons, are known as fruits. A hickory nut has an inedible seed covering, a peach has an edible one; but each is a fruit of a tree.

12. That Hummingbirds never alight. Of course they do, and often. But the Chimney Swift, having rudimentary legs, never

alights except to cling on the inside of a chimney or hollow stump, and probably stays on the wing more than any other bird.

13. That Newts and Salamanders are lizards. They are not, nor are they reptiles, but amphibians, related to frogs and toads.

14. That wolves hunt in packs. In a recent issue of the *American Mercury*, Vilhjamur Stefansson exposes this age-old fallacy which has grown hoary in the service of thrilling literature.

15. That the "frog-spit"—otherwise known as "snake-spit"—on the grass in summer is poisonous to touch. This tiny fleck of froth so commonly seen on the grass blades of a meadow is made as a protection to himself by an immature insect known as the "Spittle Insect" or "Frog Hopper."

16. That poisonous fungi are "toadstools"; edible ones "mushrooms." The word "toadstool" has only a literary meaning and no botanic standing. Poisonous and non-poisonous mushrooms are found in the same family, and mere form or color is no basis of distinction between them.

17. That spiders sting or bite. Only one or two large varieties could possibly puncture a

human skin if they tried; none are poisonous except the Tarantula, which sometimes comes north in bunches of bananas. A spider bite is very rare.

18. That Skunks habitually prey on chickens. This is a rare occurrence—probably a last resort—as skunks live on much smaller game, such as insects, frogs, young mice, birds' eggs, and the like.

19. That all hawks are "hen hawks," and therefore to be shot on sight. Only two kinds of hawk ever prey on the hen house denizens, the Sharp-shinned and the Goshawk, and these are easily distinguishable from the four and five larger hawks which are beneficial to the farmer.

20. That Dragon Flies will "sew up your ears," and that they sting horses and people. They are in fact perfectly harmless and an exceedingly interesting object of study.

21. That snakes if hurt will not die until sundown and that snakes sting or poison you with their forked tongues. A snake's tongue serves only as a feeler. Like all *reptilia*, they are cold-blooded and relatively sluggish so that death comes slowly after a mortal injury.

Map-making *Par Excellence*

NEARLY every out-of-door landscape-owner and horizon-landlord has risen up in his day to call the United States Geological Survey maps blessed. Those topographical maps, made for the most peaceful of pursuits, but with all the exact minuteness necessary for war purposes, are to semi-professional walkers the choicest article of a field equipment. "A mile to an inch" is an appropriate motto for the walking enthusiast, who counts his inches as automotive individuals count their milestones.

Already nine states (among them Massachusetts, New Jersey, Connecticut, Ohio, Pennsylvania, and West Virginia) have been *completely* mapped on this large scale by the myopic eye of the United States Geological Survey. And, in all, 43 per cent of the whole national area. It has been done with an amount of labor and care that seems well-nigh incredible. With each standard sixteen-mile-square map, we have spread out before us a view of the countryside quite similar to one a soaring hawk or an aviator flying a mile high, would

get. Every lane is there, every cross-road, every hill and valley. Even as we travel through settled communities map in hand, each detail of street and suburb stands out uncannily perfect. When we get off into the mountains, however thick, wild and untrailed our way may become, we can glance confidently at one of these trusty maps, and know that Uncle Sam's intrepid cartographers have been there before us. Here on the maps is an insignificant trail from Black Dome to Indian-head Mountain—if we travel it we shall find it just as crooked, crossing precisely the same brooks and elevations as in 1894 when it was so faithfully plotted.

The vast plan of the Survey was begun in 1886 by Congressional appropriation and since then has dragged along its 35 years of achievement partly aided by State contributions, but always too meagerly financed by State and Nation to be able to push its ambitious vision to reasonably prompt reality. Fifty-seven per cent of its projected work is unaccomplished to-day. At this rate another forty years will be needed! But the topography already covered has been admirably done in three thousand engraved plates, that show almost every shed and cabin in existence at the time in 1,300,770 square miles of territory—surely no insignificant accomplishment!

How often has it happened to us afoot that a tiny black dot which in 1890 represented a dwelling or remote hay-barn on some unfrequented road or bridal path, turns out, when one has toiled through briers and thicket to reach it along a well-nigh unknown trail in 1921, to be only a pile of tumbled-down rubbish. Yet in rural districts the relative infrequency of building innovations over a period of 20 to 30 years is most remarkable: many a tour of 50 miles will reveal scarce an additional dwelling or road or even a new barn since the map was finished two decades ago. Many of the maps, however, have been recently completely redrawn.

Is there a more fascinating feature of your vacation walk, cross-country, than unraveling one of these Survey Maps? All your highways and byways are there: trails, railways, tunnels, bridges, fords, canals, locks, abandoned mines, dams, levees, ponds, springs, marshes, cliffs, and what not else—more information, more running commentary on the neighborhood, then a five-foot bookshelf of guidebooks could present. I have often wondered if Switzerland, France, Norway or Canada, is as well-mapped as United States. I have never seen such maps when traveling in these lands, but it would have added much to my rambles therein if

I had been mentored by as painstaking a Geological Survey * as our own in Washington.

* A reader of this book who is as yet unfamiliar with these invaluable maps, may write to the U. S. Geological Survey, Washington, D. C., for a key or master-map of his particular State. From this key, which has the various quadrangles named into which the State has been cut for mapping, can be ordered the particular maps desired. The Survey will also advise you of the dealer nearest your home who carries a more or less complete stock of them. The cost is trifling.

A Week's Walk

THE automobile has done its worst. It can take you there; it can give you a start; but to walk is the only possible way for a nature lover to further his hobby. It is as ideal a way to awaken in children a lasting interest in the out-of-doors, as it is to release adequately the suppressed longings of the city-tethered adult. The automobile has reached its limits; there is of late a sudden tendency to remember the holiness of feet and the benediction of Back-woods solitude. Young college people are beginning to appreciate Nature more as their grandfathers did, and the eagerminded youth of the labor movement are turning to country walks as a week-end diversion far surpassing sleep and the Sunday newspaper. Yet one cannot say ours is a walking populace! Ah no, but you may auto-camp as the writer has done over many States, and walk over counties galore, and everywhere, town and country, you will meet wistful men and women who will manage to remark during the conversation: "So you *really like* to do this sort of thing? . . . Well . . . you know, *I* always wanted to try it too, only, only . . ." Such a confession is al-

most sure to come out—one gets to expect it, to wait for it. Amusing, but pathetic! It is, alas, not yet very *fashionable* to walk!

But *you* have concluded to *do* it. *Bismallah!* . . . There is one book which everyone contemplating out-of-door camping should possess. It is a classic, whose scope and practicalness has, in my judgment, never been equalled: Horace Kephart's *Book of Camping and Woodcraft.* Perhaps it is a little too advanced for the utter tenderfoot, a bit too professional; but read it, anyway! Swinging perhaps too far in the opposite direction are three other books full of valuable hints and ideas: *The Boy Scout Scoutmaster's Handbook,* and the *Scouts' Handbook* itself, also *The Woodcraft Manual* of the Woodcraft League of America, written by E. T. Seton, which contains a vast amount of information.

Mr. Kephart says:

"An old campaigner is known by the simplicity and fitness of his equipment . . . every article has been well tested and it is the best his purse can afford . . . He has learned how to fashion on the spot many substitutes for 'boughten' things that we consider necessary at home. . . .

"The art of going light but right is hard to learn. I never knew a camper who did not burden himself, at first, with a lot of kickshaws that he did not need in the woods . . . Let me not be misunderstood as counseling anybody to 'rough it'

by sleeping on bare ground and eating nothing but hardtack and bacon. Only a tenderfoot will parade a scorn of comfort and taste for useless hardships . . . As Nessmuk says, 'We do not go to the woods to rough it; we go to smooth it—we get it rough enough in town. Let us live the simple natural life in the woods and leave all frills behind.' "

If one goes to a large camp-outfitters (expense being no object) he may of course get a variety of fancy foods, most of which are made to sell rather than to fill a real need. He may be enticed by a score of gim-cracks in the way of conveniences and devices, a few of which may be employable *often enough* to be worth carrying, but most of which he can get along without, or for which he can make a satisfactory substitute with knife, hatchet and pliers.

We are not now talking about sheer wilderness trailing or hunting expeditions, but are presenting to the tenderfoot a few ideas as to how to go on a comfortable hike of a week or more through the backyards of civilization. We can recommend the following as an outfit for two. Since you are to carry all of this, it is well to go as light as possible, not taking anything unnecessary on the off-chance that you might have use for it. This outfit is not intended for automobile camping tours, or for residence in a "permanent" camp.

Tent. While, of course, there are others which might fit your ideas closer, we have used the Sportsman's (or Walker's) Tent,* for years and know of nothing better. It weighs but six pounds, is water- and insect-proof, and costs around $13. Another good tent called the "Tooman Tent" † is more expensive and should last for many years. Both roll up compactly to carry on top of the rucksack. The standard army pup-tent, buttoning together from halves, one carried by each walker, is not insect proof and has no floor, but would serve capitally for autumn use, trenched around to turn water aside. These are very cheap and can be purchased in almost any city. For any such tents, cut your stakes where you camp. Two light blankets, two thin light raincoats, and two large water-proof German-style rucksacks, will make you as unmindful of rainy weather as is possible. Usually, if insects will let you, you will sleep *on* your tent under the stars, not *in* it.

Accessories. Two army-style mess-kits holding knife, fork and spoon (and useable as both fry-pan and plate); a two-quart aluminum pail in which nest two roomy aluminum handled cups; a general-

* Made by the Compac Tent Co., 1172 West 28th St., Indianapolis, Ind.

† Made for Abercrombie & Fitch Co., Madison Ave. at 45th St., New York City.

purpose sharp and short butcher-knife; and a long-handled spoon—these make up your cooking and serving utensils. (Soot-blackened dishes should have cloth bags provided for them to slip into.) Each person should have a practical jack-knife; the so-called Boy Scout knife, with four kinds of blades, is a fine tool—don't buy a cheap one! If you can also take along a little skillet, or sauce-pan, it will be very convenient. A small canteen is sometimes indispensable. Carry one fitted with a shoulder strap. Other accessories might include:

U. S. Geological Survey Maps.* (I mount mine on cloth, and carry in an oilcloth envelope.)
Fishing tackle. (Cut a pole where you fish.)
Collapsible drinking cup.
Flashlight.
Minimum toilet articles. (Carry soap and matches in flat metal holders.)
Few assorted safety-pins and nails, some stout cord, roll of copper wire.
Light scout ax—though I have *never* carried an ax.
Small box of ointment, adhesive plaster, roll of bandages, cathartic pills, iodine, and possibly citronella or some other "fly-dope."
Field glasses and a notebook.
Fountain pen or pencil.

Clothing. Wear old clothes: khaki drill defies briers and mosquitoes, and the army-style shirt

* See suggestions under *The Overnight Hike for Children*, page 268 and also *Map Making Par Excellence*, page 186.

with two pockets is warm and handy. Underwear is more important for walkers than are the outer garments; make it light, and use a sweater or sweat-shirt for cool hours. Your shoes must be broken-in and comfortable—rarely do conditions require fancy and costly high-top walking shoes; they are heavy and hot. Flat heels—of rubber—are essential. Have shoes large enough so that two pairs of socks, an inner pair of silk or cotton and an outer heavier pair, will fit in with ease. Omit hat or cap unless completely inured to them. As extras, take these:

Two or three pairs of socks.
Suit of underwear.
Rubber "sneakers," or other very light shoes, for evening and morning wear.
One handkerchief, a large one, to go around neck or head if flies are troublesome.

Food Choices. In general, weight is a rough measure of nutritive value. For a week or less a balanced diet is not at all essential. Fish, berries, nuts, game, frogs'-legs, and the like, sometimes help out considerably. Personally, I have little use for dried fruits and vegetables, as what you swallow is mostly the water you add to them. The food items suggested below are put in with reference to (a) their availability (b) food-value (c)

carry-ableness and (d) keeping-qualities. In many localities, eggs, bread, and milk, can be bought at farms. These three things materially shorten your list and, if you are quite green at tramping, you can so plan your itinerary as to be within reach of farmhouses every day or so. Occasionally a bit of meat can be bought at some village.

Food *quantities* are not mentioned—they must be determined by intelligent reckoning and suited to the appetites of the individuals. Make selections from:

Butter (to be carried in a tight-covered mayonnaise jar).
Peanut butter (in a small jar).
Bacon (take plenty of it).
Rye bread (keeps best).
Bouillon cubes (in flat tins).
Tea and cocoa (tea in cloth portion-bags, or else take a *strainer*).
Powdered milk, or condensed milk in small cans.
Small can Postum or soluble coffee.
Brown rice (the *whole* grain).
Condiments and sugar (in small friction-top jars or tins).
Prunes, raisins, dates, figs (wrapped into *flat* packages).
Sardines.
Hard-boiled eggs.
Corn-meal.
Potatoes (a *few* apiece).
Dried beef or sliced ham (not in bottles, but in flat parcels).

Tuna (small flat cans).
Hard candy.
Prepared pancake flour (transferred to a flat tin).
Macaroni and spaghetti (the long thin boxes).
Sweet chocolate (not the thin milk-chocolate bars, as they melt readily).
Nut meats.
Citric acid crystals for lemonade (or Lemonade Tablets—Wyeth).
Dried soups (the German-made kind).
Canned soup (perhaps one or two cans).
Salt pork. (It is essential that plenty of *fats* be eaten while on a tramp, for the system seems to require it. Use your bacon-grease freely, too.)
Cheeses—of many kinds. (But don't eat cheese freely, it is too costive.)
Triscuit. (The perfect cereal is *whole* wheat, and as bread it is, of course, far better than in any fancy breakfast cereal made to sell at higher prices; Triscuit, however, is compact and tasty, and does not contain the moisture bread does.)
Rye Crisp makes a good variant with Triscuit.
Powdered eggs—if you are to cook very much.
Canned Beans. (They are filling enough to warrant the awkward container.)
Gold Dust (a few ounces in a paper bag for dish cleaning).

Plan to make your first and second day's distances rather short, as the first thirty miles are the hardest. Also plan your first meals so as to consume some of your weightiest and most awkward sup-

plies early on the trip. May we pray, furthermore, that you obliterate from your mind the idea of stunning your friends by reporting what enormous stretches you were able to cover. You *can't* break records, but you *can* make your walk exhausting!

PART TWO

Some Nature Projects for the Modern School

". . . And he wandered away and away,
with Nature, the dear old nurse,
Who sang to him night and day the rhymes
of the universe.
And when the way seemed long, and his
heart began to fail,
She sang a more wonderful song, or told a
more wonderful tale."

—LONGFELLOW, "Agassiz."

Foreword

THE projects herein suggested are presented for the benefit of the Group Teacher. To the experienced Nature Study instructor, they may yield but little that is really new, but few modern experimental schools employ such persons.

They are such as would serve to hold the interest and invite the responsibility of a Group for weeks, in some cases months, of the school year.

They are practical for a teacher, who is not a specialist in Nature Study, to put through and adapt to the informal character of the progressive modern school.

In books devoted to courses in the standard Nature Study of the public schools, urban and rural, can be found scores of studies, "stunts," and experiences in Nature lore, to serve as objects for a walk, a few days' attention, or a school hour. These have their value. Here, however, we point out some projects which have been proved by experience able to hold the continued interest of children and, what is more important, afford valuable modes of contact with the natural world from which

many other juvenile researches and enthusiasms will readily radiate.

Parents also may find projects in these pages which they may conduct at home, to their offspring's delight and the envy of the neighborhood.

"It is sometimes well not to read too much, lest the joy of original observation be lessened."
—P. G. Howes, in *Backyard Exploration* (Doubleday, Page; 1927)

The Observation Beehive

UNLESS one is pretty familiar with bees, we do not advise attempting to construct a home-made observation hive. Much better results can usually be obtained from one made by experts and specially designed to fit the needs of the schoolroom. We would, however, urge a teacher to study thoroughly the habits of bees before purchasing or installing an artificial hive at her schoolroom window. This project is best started in April, and usually can be kept operating through the summer, the following winter, and on indefinitely, by following the directions supplied by manufacturers with the commercial observation hive, and mixing these directions thoroughly with equal parts of wisdom gleaned from the literature of bee-keeping.

There is not much danger of bee stings if children do not pass through or play near the line of flight of the coming and going bees. Although the hive is within the room, its exits are through holes in the bottom frame of a window or under its lifted edge, no bees get into the schoolroom. The bee sting menace is exaggerated, as any experienced apiarist will tell you. Some persons seem to be able

to handle bees with impunity; others are special targets for their ire. We have managed beehives for years at home, and cannot recall more than a dozen stings all told. If one is stung, there is little that can be done. If the bee has left the lower tip of its abdomen attached to the point stung, or if the sting itself still sticks in the wound, it should at once be gently brushed off *sideways* or lifted with forceps. Application of ammonia to the spot, followed by a sticky poultice of wet mud, generally eases the pain.

The commercial schoolroom hive has sides of glass shielded by lifting-slides. Through these may be seen much of the far-famed domestic economy of bees. The hives are made in different sizes. Full information can be had from one of the largest bee-supply houses,* who manufacture them. The literature of bee life and artificial culture is so wide that every public library catalog should be able to provide some titles. *The A B C of Bee Culture* is as good a practical book on bee-raising as there is.

* The A. I. Root Company of Medina, Ohio.

An Indoor Anthill

HERE is a very good one! Even if teacher and children may not be skillful enough to make a bee-hive, they can make an ant-nest. And they can stock it without danger of stings. It is a school-year project, too, and probably could be maintained for two years, if proper care were given it through the summer. One I had thrived famously for nine months, and then the whole was returned to the fields whence it had come.

Since I first obtained my directions from that source, I will quote from Anna Botsford Comstock's *Handbook of Nature Study*, for that expert's words cannot be improved upon:

"*Material*: Two pieces of glass, 10 inches square; sheet of tin, 11 inches square; piece of plank, 1¼ inches thick, 20 x 16 inches; another tin sheet 10 inches square.

"Take the plank and on the upper side, a short distance from the edge, cut a deep furrow—a moat to keep the ants imprisoned. It is necessary, therefore, that the plank should have no knot holes, and that it be painted thoroughly

to keep it from checking. Take the sheet of tin 11 inches square and make it into a tray by turning up the edges ⅜ of an inch. (Note by author: you have to cut a slit into the four corners of this tin in order to bend it thus.) Place this tray in middle of plank; in the tray one pane of glass. Lay around the edges of this glass four strips of wood about half an inch wide and a little thicker than the height of the ants. Cover glass with thin layer of fine earth. Cut a small triangular piece off one corner of other glass (with *sharp* glass cutter!), then place this pane on top of the pieces of wood around the sides of the lower pane. Cover of the nest may be a piece of tin, with handle soldered to its center, or a board with a screw-eye in center to lift it. There should be a piece of blotter introduced into the nest between the lower pane and the dirt, in position where its edge may be reached with a pipette tip without removing the upper glass, for *it must be kept damp always.*"

Ants, like bees, have in every colony a queen whose sole function is the laying of eggs, and it is useless to collect a batch of wild ants without securing a queen. If you take a large fruit jar and a stout garden trowel, or a spade, and enter a neighboring field, you can readily locate a small ant-

colony under a stone. The insects bring up from below every summer day both the real eggs and those "eggs" which you will discover not to be eggs at all, but pupa-cases of already hatched larvæ, to give them the benefit of the warmth which the sunshine imparts to the stone. With these pupa-cases will often be found the white larvæ not yet ready to go into the pupa stage. The true eggs are, of course, much smaller objects than either. Scoop as many of the ants, eggs, and young into your jar as you can.

Now dig down a foot or so and search for the queen, which is a much larger and different looking ant. It may be that you will have to disrupt ant-nest after ant-nest before you secure a queen. In every case, if you do not find the mother of that particular home, you should dump back the ants and the debris you have put into your jar. Members of different nests should not be mingled, as they can tell each other apart, and often do not get along well together. There are at least three different species of ants you may run across, all of which are equally desirable. But bring home no more dirt than necessary. Comparisons of two species, by means of two indoor nests, will add to the fun.

Dump out the contents of the jar upon the *top* of the cover board. Fill the "moat" with water.

Then set the ant-nest in a quiet, but not dark, place, and leave it alone for several hours. Eventually the ants will discover the hole made by the cut-off corner of the upper glass and will gather up their young and take them below the glass where it is dark and damp. Orderly home-keeping begins next day. The dirt left upon the cover-board should be removed, and the heavy blotting-paper kept moist. The cover may now be removed, though only at infrequent intervals, for observation of the colony's domestic affairs. Bits of fruit, tiny pieces of meat, grains of sugar, flour, and the like, placed inside the "moat" will feed them well.

Books upon ants and their habits are legion: good accounts are given in Howard's *The Insect Book*, and in the above-quoted *Handbook of Nature Study*. Sir John Lubbock's classic, *Ants, Bees, and Wasps*, has a vast amount of material for further study and experiments with your captives.

The above artificial nest is one devised by Sir John Lubbock and called by his name. There is another type, called the Fielde nest, harder to make, which can be looked up in other treatises about insects. In Dr. Howard's book are pictured other cases and cages for indoor rearing of various insects, should you wish to pursue these intriguing studies in entomology any further.

Keeping Track of the Sun

The lengthening of daylight, especially in late winter, calls attention to the progression of the points at which the sun rises and sets. All four of the cardinal days of the sun's progress may occur during the school-year, September 21, December 21, March 21, and June 21. Keeping records of the sun-shadow, and constructing monuments to establish such data, were primary concerns of the priest-craft of ancient man: to-day it is rare that anyone pays any attention to this cosmic phenomenon. One appealing project for a class is to indicate by means of two points, either by placing two markers upon the grounds, or one on the grounds and the other at the window, and the point where, throughout the winter and spring, the sun rises on various days and the point where it sets. If sunset and sunrise occur too early and too late for observation, taking the position of the sun at a given early hour in the morning and the latest possible hour in the afternoon, will serve nearly as well. The progressive, week to week record is the thing.

Also, if sunlight falls through a window or door

facing south or nearly so, the top of the area of sunshine upon the floor may be marked from day to day by means of little square pasteboards bearing the date and tacked tightly to the boards. Such a line of indicators on the floor is a very graphic record of the sun's "height" as it climbs or recedes through the sky. In one schoolroom, small dashes of black paint were made upon the floor and the dates lettered alongside. This made a more permanent record which could be checked the following fall, and many intervening dates were added from year to year. Neat, thin, painted lines, radiating from a central spot, form an even better graph of the sun's movement. These mark successive shadows of a vertical door- or window-casing.

These projects naturally lead to interest in making and setting sun-dials, and the recording of time by clocks of many kinds throughout history. Indeed, they open wide vistas of study concerning religions, deities, holidays, and customs all over the world.

Doing Something About the Weather

THE now thoroughly hackneyed saying of Mark Twain that although everyone discusses the weather, no one does anything about it, can be contradicted by such a procedure as this:

A Weather Calendar for the school year can be constructed in nine sheets like a large wall-calendar. The squares representing every day of the month may then be colored or otherwise designated in such a way as to represent the kind of weather that has occurred. Each square may be divided in half, if desired, to show morning and afternoon weather. Such a project draws the attention of children to weather conditions which they are apt to take no notice of, and will often awaken the first interest in nature that a child evidences. When done by a child on a large scale and in bright colors, such a chart is a showy and graphic thing, and may be a decoration of permanent interest on the wall.

If practicable, the outdoor temperature at a given hour or hours may be entered each day upon the calendar, together with the wind-direction and force, the amount of snow or rain, and even the

daily barometer reading. If the children are taught to follow the code standardized by the United States Weather Bureau for indicating weather forecasts, these signals will become familiar to them. If the daily official weather forecast can be posted, its accuracy or failure might be noted in some manner.

When birds begin to come back in spring, a tiny colored picture of each new arrival can be put into its proper day-square; and so with butterflies, the peeping hylas, wildflowers, and other notable nature news.

Naturally, as a side issue to this pursuit, will come the construction of wooden weather-vanes and windmills, and their permanent erection where all winds will strike them. Even a barometer is not too difficult an instrument for older children to make.

Your Own Christmas Tree

The traditional Christmas Tree is the Tannenbaum of Germany, a Fir. In Eastern America, we have no Firs of this type but, for many generations, have employed the White Spruce and also the Balsam Fir, whose branches, however, are not as suitable as those of Spruce. The Spruce grows in a native state only in a Canadian-type flora, that is, it can be found wild only upon mountains or high altitudes until you reach nearly the northern boundary of the United States.

Therefore, to carry out the project here suggested, one of two things usually has to be done. Either you can order from a nursery a Norway Spruce or a White Spruce, with its root-mass nicely bundled and bagged ready for planting; or you may locate one of these little northern trees on the property of someone friendly to your school who will allow you to transplant it from his grounds. Evergreens transplant best either in April or after October 1. When digging one up it is absolutely necessary to take up a large, uninjured root-mass, preferably with a considerable amount of undisturbed earth clinging to it.

A strongly made tub, concrete bowl, heavy box reënforced by sheet-iron straps, or something of the sort, so constructed as not to be warped or bulged out of shape by the damp earth within and at least two feet across, will suffice for a four-foot evergreen during one winter. If planted in such a container, kept well-watered and not allowed to freeze, although frequently placed outside in the sun, your Yule-Tree-to-be will grace your schoolroom in good health until Christmas. For your Christmas exercises, its branches can be lighted by the children with electric bulbs, decorated just as a slaughtered tree from the dealer would be, and afterwards preserved until it can be planted outdoors by the group in spring.

Our native Christmas trees, Spruces and Balsams, are fast being depleted by the annual raid upon their young saplings, and hence the custom of employing a live tree for the occasion is growing in popularity. By following the above plan, you will have saved one tree life, added a tree to grace your grounds, and driven home to a group of children a lesson in forest conservation that they will not forget.

A Winter Woodchuck

Woodchucks begin their hibernation earlier than any other American mammal. They are apt to turn in for the winter before October 1, having fed themselves into a scandalously unmodish obesity during the last few weeks. They do not ordinarily reappear before the end of March, although you may occasionally see them out reconnoitring on the snow crusts long before that. The origin of the beloved old fable about Ground Hog Day and its shadow is lost in mystery, but if it started in America instead of in Europe it must have been in the South, because February Second, north of Washington, is far too early for 'Chucks to be stirring.

They can be dug out by any determined person, though it is no easy task. Since it is beyond the strength and staying power of any but the most robust of fifteen-year-old boys, the securing of a 'Chuck for the schoolroom is usually a matter of offering some farmer or hired man five dollars to go a-digging. By persistence you can surely get someone, lured by the promise of financial reward, to undertake the job. This must be done before the frost has entered the ground very deeply, say

during November. Ten feet is about the average length of the burrow and in order that the occupant may not be drowned out, he constructs his sleeping chamber a little above the level of the hole.

When Woodchucks are thus brought from their state of semi-coma; confined in a suitably dark box, they do not revive much, but only rouse up sleepily now and then, and go off to sleep again. Although I have never taken a 'Chuck to board for the winter, I have known others who did. Their experiences tallied closely with the remarks of John Burroughs (in *Pepacton*, Riverside edition):

"His long sleep is rendered possible only by the amount of fat with which the system has become stored during the summer. The fire of life still burns, but very faintly and slowly, as with the draughts all closed and the ashes heaped up. Respiration is continued, but at longer intervals, and all the vital processes are nearly at a standstill.

"Dig one out during hibernation (Audubon did so), and you will find it a mere inanimate ball, that suffers itself to be moved and rolled about without showing signs of awakening. But bring it in by the fire, and presently it unrolls and opens its eyes, and crawls feebly about, and if left to

itself will seek some dark hole or corner, roll itself up again, and resume its former condition."

If confined in a barred or screened box lined with burlap bags, there is no doubt that a Woodchuck would remain nearly quiescent all winter and afford a unique object of interest. Instead of attempting to feed and tame it in the spring, for Woodchuck adults are very difficult to tame, it should be liberated as soon as grass has started. If the 'Chuck should require food before that time, any green stuff will answer, together with apples, carrots, and the like. But beware those sharp teeth after once he becomes lively! When cornered or penned, he is an utterly fearless and dogged fighter.

Stone & Cram's *American Animals*, has a most informative treatment of the Woodchuck. And Mr. Burroughs in *Riverby* relates a charming account of a baby 'Chuck reared by him.

A Collection of Snakes

THERE are nine harmless snakes in the Northeastern States. In order of their most frequent occurrence, they are Garter, Milk, Grass, De Kay's, Black, Water, Hog-nosed ("Puff Adder"), Red-bellied, and Ring-necked. If you count the Ribbon Snake as a distinct species from the Garter, it makes a tenth. De Kay's is a little fellow, also called Brown Snake, and likely to be confused with the Garter. The Water Snake has always been hardest for me to capture, and a close second is the Black which is almost impossible to catch up with, once it starts to run away through the brush. The others are all easy to collect. No one who is really afraid of snakes is likely to be much of a success at catching them, but of a group of twenty children of assorted ages, at least fifteen, although at first they expressed great repugnance, were soon won over to handle them almost without fear, by watching others do so. At first, they forced themselves to touch or stroke the snake gingerly while another person held it; then they proceeded by degrees to handle it themselves. That no child should ever be permitted to chase another or scare

him with a snake goes, of course, almost without mentioning. There has always been a peculiar satisfaction to me in seeing a child conquer its so-called instinctive fears, particularly in the case of reptiles, and I believe such a victory is good education.

You need not make a definite campaign of catching and caging an assortment of snakes; your children will occasionally run across one and, if encouraged to bring them in, will soon accumulate a small zoo of them. Even one or two, if properly handled and studied, will form a source of unusual fascination to a school group. The very common Garter (sometimes locally known as the Garden Snake) soon becomes tame and seems to enjoy being handled.

If no purpose is to be served by keeping them captive more than a week or two, they do not need to be fed, for they can go long periods without eating. If, however, you desire to try for eggs or young from your captives, you must provide large and comfortable cages for them. In winter they all hibernate if their quarters are kept cool enough, but are sluggish even in fairly warm rooms. Practically all snakes will eat earthworms, salamanders, mice, small toads and frogs, insects, and bird's eggs, of sizes proportional to their own. The Garter Snake brings forth her little ones alive, and in

large litters; the others lay eggs and will sometimes do so when caged in roomy, darkened dens. But the best chance of their breeding in captivity is to have them caught in spring just before the eggs are to be laid or the young are to be born. Should you wish to keep snakes for some time, you will need to read one of the standard books about them in order to provide for them properly. (See Ditmar's *The Reptile Book.*) Snakes like a depth of loose moist earth in their cages to burrow into.

To capture such large specimens as full-grown Blacks, Water Snakes, and Milk Snakes, use a three-foot long stick with a short fork at the end to press down over the neck just behind the head. Once you hold any kind of a snake securely just behind the head, it cannot strike at you. The Black and Milk Snakes, being constrictors, usually coil their bodies somewhat strongly around your arm as you hold them, but their strength is nothing to your own. A cloth bag is the handiest thing in which to carry them home.

The Hog-nosed Snake is a reptile comedian. With the fiercest of snake gestures, hissing, coiling and recoiling, inflating, and sometimes even advancing towards you, it does all its "stuff" to bluff you. But strike the ground beside it sharply with a stick, or poke it gently, and all the "fight" leaves

it. Either it will "play dead" at once, or clumsily attempt escape. I have never been able to make one actually try to bite me or anything I held toward it. Two feet is its usual length; it has a triangular head (as most *venomous* snakes have) and an upturned snout-tip for rooting out its prey of grubs and worms from the soil.

It is the Copperhead that one must know how to identify, for it is one of the two poisonous reptiles there is any real likelihood of running across in northeastern America. It haunts wild, forsaken, rocky sites where few people wander. A triangular copper-colored head and dumb-bell shaped transverse markings of dark brown on the back upon a lighter brown ground, are its distinguishing markings. It is usually not over a yard long. Farther south—but that is another story! . . . Rattlers have been discovered in the wilder spots of the Alleghenies, Ramapos, and Catskills, but it is a rare experience. The harmless Water Snake is commonly miscalled the Water Moccasin by men and boys who hunt and fish, and those found in the vicinity are usually believed to be deadly. In fact, however, the Water Moccasin has almost never been seen by experts north of Virginia.

The Microscope World

Put away the high-power objective when you bring out the microscope for children. What it shows often baffles them, even if adjusted properly, and it is too difficult for a youngster to manipulate. If you want to stage the drama of blood circulation in a tadpole's tail or frog's foot, well and good, that is excellent "theatre." * But Nature Study hovers halfway between the indifferent, casual glance and the super-intimacy of the three-fourths objective.

All modern education in biology and physiology starts with talk about cells; in chemistry, with assumptions on atoms. Likewise much of Nature Study calls for the use of the hand-lens and low-power microscope. To neglect the low-magnifying microscope is to miss a large fraction of nature's everyday miracles. There are many things to look at, and a new orientation will result from new con-

* Partly etherize or chloroform a frog or tadpole by wrapping it for a minute or two in a cloth damp with the drug, just enough so that he will not wriggle. Place him on a thin board with a hole in it, over which spread the thin tail or web membrane. Adjust this under the low-power lens and observe the corpuscles slipping hither and thither through the blood vessels. This exhibit is as thrilling as it is simple to prepare!

cepts as to the size and the nicety of the adjustments living things have developed in their inmost processes. For instance, run these below through the mill of magnification during a winter, and what will not be found of wonder and surprise:

dust
sugar
pin point
needle point
cotton batting
fabrics
diluted milk, cream, blood
pencil and pen marks
yeast
insect eggs
water-flea, *daphnia* or *Cyclops*
salt
sand
film negative
half-tone print
chemical crystals
feather
ink writing
breadmold
fern spores
Spirogyra (green pond scum)
grass seed
pollen
puff-ball "smoke"
anthers
stigma tips
hair "roots"
flake of skin callous
butterfly wing-scales
typewriting
spider web
fly foot
leaf-lungs (stomata)
dewy leaf

A Hint for School Gardens

Preparations for a school garden are often left until the last minute, with the result that practically no flower blossoms or vegetable matures before the year ends. Two projects started early enough will prevent this: the outdoor hotbed, and the raising of plants indoors. Then, as soon as severe frosts are over, the plants already well-grown may be transplanted to the garden.

To make a satisfactory small hotbed, you must buy a glass hotbed cover or two. Then dig an oblong hole on a southern exposure to a depth of two feet and of a size the dimensions of the cover. For each side of the bed, cleat together two eight-inch boards, making the dimensions of the box such that the covers just set into it, and rest on the cleat-ends. The whole box should then be set into the excavation with the north side four inches higher than the south. Enrich half the dirt dug out with plenty of well-rotted manure and replace it inside the set frame. Lettuce, radishes, tomatoes, sweet peppers, corn, melons, squash, onion sets, pansies, Canterbury bells, larkspur, foxglove, candytufts, nasturtiums, poppies, sunflowers, zin-

nias, geraniums, petunias, and many other plants will suggest themselves as capable of being transplanted.

The soil must be watered daily. When the sun shines clear, the frame-covers must be lifted slightly to allow the heated air beneath to escape, else the interior will become overheated. Usually, after April 10, the covers are left off during the day, being replaced when necessary at night.

Lacking the hotbed, you may employ seedling boxes to the same end. Make these of inch boards, wide and shallow, 4 inches deep, and be sure to nail strap-iron tightly around from side to side over the nails to provide against the warping and consequent nail-pulling almost certain to occur because of the damp earth inside. Choose soil that is rich and black. Keep damp, but not too damp, and let the sun fall on them as much as possible. Likewise small clay flower-pots set in shallow tin plates for cleanliness, are ideal for growing on a small scale flowering plants to be set outside later. Sometimes a child may like to use eggshells as tiny flower-pots. The tops should be removed and the eggs filled with earth, and set snugly in moss or sphagnum in a square cake tin, and kept very moist. One seed is enough to a "pot." The shells are porous enough to let dampness through to the roots.

I have seen one large set of these in use, each of which had a bright-colored rim painted around the top of the shell—a charming effect.

It need hardly be mentioned that planting bulbs indoors in pots or boxes of damp earth will start them growing, either to be transferred outside early or left therein until they bloom. Crocus, snow-drop, narcissus, daffodil, hyacinth, tulip, all the bulbs, can be started thus in midwinter. I can never understand why this is not lavishly done in every schoolroom for esthetic reasons alone!

Such spring wildflowers as Dutchman's Breeches, Squirrel-corn, Hepatica, Violets, Jack-in-the-pulpit, Wild Ginger, and the like, may be dug up from the leaf-covered floor of the woods at any time in winter, on a sidehill facing south where there is no frost, and will bloom after a fortnight or so of indoor life in a flower-pot or bowl. The ferns will awaken, too. Christmas Fern keeps green under the snow throughout winter, and is a fine holiday-green, either as a growing plant or as separate plucked leaves.

Making Maple Syrup

If there are sugar maples near the school, why don't you tap them? Almost all children I know would be overjoyed at the chance.

Expense? None at all, except for fuel, and perhaps the school kitchen or an outdoor arch will save that.

Acer saccharum, the Rock or Sugar Maple, resembles only the Red Maple and the Norway Maple. The former blossoms in early spring before the leaves come out; by tapping time, its fat or bursting red flower-buds make it readily distinguishable from Sugar Maples, as does also the smooth light gray color of the upper limbs. Then, too, its lower trunk is not nearly so rugged. Norway is an introduced species chiefly planted along streets and before it leaves out its large, red, blunt-pointed, glossy buds are distinctive.

Tapping. Using a half-inch auger-bit, bore a hole two inches deep and slightly up-slanting, from three to four feet above the ground. Begin tapping with the first breakup of continued winter weather, in late March or early April, when frosty nights and warmer days are the rule. Two to four

tappings should be made on big trees—on sides where sunshine will fall.

Spiles or spouts. Use straight, unknotted woody stems of the Elderberry, cut in sections five inches long and about three-fourths of an inch thick. Whittle one end so that the pith is exposed in a flat cut extending back an inch from the end, and slightly sharpen the other side so that this end can be driven into the tap-hole. Whittle down one side (the upper) of the other end similarly, so that the pith chamber is half cut through. On this end, the pail is to be hung; therefore, cut a slight notch across this spout to hold its handle. Make this transverse notch at such a distance as to allow the pail to hang straight down with its side flat against the tree after the spout is driven in. Now, with a piece of stiff wire, punch out the pith for the whole length. Drive the "spile" gently into the bored hole of the tree until it fits snugly. Sap should start to flow through it at once. (Of course, commercial metal spiles can be purchased at trifling cost.)

Buckets. Round tin coffee cans, or receptacles of such a nature, fitted with a handle of light wire through holes pierced by a nail in the upper rim, serve quite well enough. They must be emptied several times on good sap-days.

Storing sap. A utensil for this purpose is sometimes the hardest thing to procure. Large, clean butter-tubs or lard-tubs, ten-gallon milk cans, or forty-gallon ones from a farm, clean barrels or hogsheads, and the like, are suggested. You must often store the sap in large quantities, for it runs faster than it can be evaporated.

Evaporating pans. The number of buckets you hang up will determine how large your pans need be for evaporating the water from the sap. If you employ a dozen or more, it would be best to borrow from some ex-sugar maker in the surrounding countryside a moderately large pan made for the purpose. (You will get approximately one quart of maple syrup from thirty-two quarts of sap.) If smaller pans must be used, two, or even three, can be used nicely, keeping one to hold the sap nearest to finishing. Keep the pans full continually while hot, and simmer rather than boil the sap violently. It is a steamy business, this boiling-off sap, and requires long vigils to keep the fire going and the pans replenished.

Finishing the syrup. This can best be done in a small way, on a kitchen stove. When sap is concentrated to a rich golden yellow and tastes very syrupy, store it for the final process. Most farmers pour about a pint of sweet milk into two or three

gallons of nearly finished syrup while it is simmering. In a few minutes, skim off what rises to the top—and your syrup is done. Take care not to let the syrup get too thick, else it may crystallize or "candy" when it cools. And then it is maple sugar!

Sap should be strained when it is poured into the evaporating pans, and usually again before finishing.

Sugaring-off, at some sugar-bushes, used to be an annual countryside festivity, and still is in parts of Vermont, I am told. There is perhaps nothing more delicious to eat than hot maple syrup, almost at the last stage of thickness, when poured upon pans of clean snow, where it will quickly harden into a gummy dainty. Nowadays, in Eastern cities, maple syrup sells at retail for around three dollars a gallon. So if the job can be done on a large scale (which, don't overlook, is a "man's-size" task!) your group may be able in this way to make some needed pin-money. One prominent progressive school in Connecticut has, for some years, turned out maple syrup on a profit-making basis.

As soon as the weather moderates so that nightly frosts are no longer the rule, the sap will cease to run briskly and will contain a higher percentage of water. It is the "first runs" that produce the finest quality of syrup. Four weeks is the longest period

the tapping season will cover; often three weeks span it. But you can stop whenever you get swamped with stored sap if you want to—or before!

"Grained" maple sugar is made by vigorously stirring the stiff, cooling syrup intended for sugar, and thus beating the air into it until it assumes a lighter color. It does not then crystallize as hard as sugar, but stays moist and soft. Its keeping qualities are not so good, however, and it must be consumed within a few days; but it is even more delicious than the cake sugar, and brings more on the market.

Attracting Bird Guests, Winter and Summer

The practice of building and putting up bird-houses by children is now so common in schools that it may seem superfluous to suggest it. However, a few pointers on the subject, gained from experience, may be helpful. I have learned:

That the form and construction of bird-boxes is limitless, no matter how many examples are pictured and suggested. Imaginative children can always "think up a new one" or make one out of odd and unusual materials.

That the four easiest birds to suit are Wrens, Bluebirds, Robins, and Phœbes.

That if English Sparrows and that imported "climber," the Starling, are common roundabout it is almost impossible to get other hole-nesting birds as tenants, but that, by keeping the hole under an inch and a half, the box can be reserved to Wrens alone.

That in general all houses should be so designed that a side is easily removable for observations and for cleaning in the fall. This makes for

greater familiarity with bird life on the children's part, and the boxes are not so readily forgotten.

That it is far more important where they are put than how they look, provided, of course, they are real bird-*homes* rather than houses looking like doll-houses or miniature summer bungalows. Since children seem usually much more interested in building them than in placing them, in admiring them than in considering them from a bird's point of view, their interest is apt to flag after the house is built. Hence they should be urged to put them up strongly and in well-selected locations. The percentage of "hits" is rather high if the locations are well chosen, although not necessarily in the first season, or for the first of two broodings in a year.

That children usually think of only Wren and Bluebird boxes; and that the making of Robin and Phœbe platforms and colony houses for Martins and Starlings usually eventuates only after some subtle urging from "above."

That children will want to provide nesting materials in the houses, which is a mistake and should be left to the birds, except that, in woodpecker domiciles, an inch of sawdust is essential, as they build no nests inside their excavations.

That rustic, i.e., bark-covered, boxes are by far the surest to win approval. Natural limbs and slab-

sided boxes, though hardest to prepare, are best. However, to the Friendly Four mentioned above, anything looks good; they are not at all particular.

That for such rare game as Sparrow Hawks, Flickers and Screech Owls, a large, roomy hollowed out, "dead limb type" of nest, wired upon the upper branches of some leafless forest tree, preferably a dead chestnut well away from human affairs, is about the only hope.

That all boxes set on poles should have a cat-guard; a tin cone nailed around the pole seven feet up.

That the following comprise about all the species one can interest in summer rentals:

For *colonial* houses:
- Purple Martin
- Starling
- English Sparrow

For sheltered platforms:
- Phœbe
- Robin
- Barn Swallow

For one-room homes (in order of likelihood):
- Wrens
- Bluebird
- Starling
- English Sparrow

Less commonly:
- Chickadee
- Tufted Titmouse

Martin
Tree Swallow
Flicker

Unusual tenants:

all other Woodpeckers
Crested Flycatcher
Screech Owl
Sparrow Hawk
Nuthatches

Out of many places from which plans and pictures of bird houses and information on the whole subject can be had, a few of the most useful are suggested in the accompanying footnote.*

As for attracting winter birds to your grounds, no better preliminary step could be taken than to peruse Mrs. Blanchan's book "*How to Attract the Birds.*" This project ought certainly to be attempted by all city or country schools as its rewards are various and sure. As many "feeding stations" as you have spots for can be operated; on

* *Bird Houses and How to Build Them*, Farmer's Bulletin, No. 609, United States Department of Agriculture, Washington, D. C.

Woodcraft Manual for Boys, by Seton, published by Woodcraft League of America.

Boy Scouts Handbook, published by Boy Scout Headquarters.

Publications of the American Association of Audubon Societies, 1974 Broadway, New York City.

Publications and information from Department of Rural Education, College of Agriculture, Ithaca, New York.

Bird Houses Boys Can Build, by Siepert, Manual Arts Press, Peoria, Illinois.

window sills, on posts in the shrubbery, against tree trunks: the more you advertise, the more casual passers-by you attract. Once a bird has discovered your free-lunch counter, it will practically always return again and again, unless the proximity of cats makes the neighborhood unsafe. It is truly astonishing how many species will come to these feeding stations in the course of a winter. Even in the heart of the Adirondacks, we have had daily visits from brown-headed nuthatches, chickadees, jays, downy woodpeckers, and many more. Chunks of suet wired on tree trunks as high as you can reach, will attract all the wintering woodpeckers, while a tray, wing-sheltered on three sides and fitted below with a fanlike board so as to catch the wind and turn away from the direction from which it is blowing, is the best possible device for seed-eaters and chickadees. Window ledges facing close to shrubbery or evergreens, especially if on the sunny side, ought not to be neglected.

A good practice to entice birds to become less shy is to scatter crumbs upon the snow every day or so; at first well away from buildings, and later closer and closer to where the permanent feeding stations are. This should be started with the first snowfalls.

Taking pictures of your visitors is very easy. If

you cannot obtain good results through the glass of the window, wrap the camera in white cloth and operate the shutter by a thread running indoors. The click of the shutter will not interfere with the birds' visits. Or let them take their own photographs by attaching a shutter-clicking thread to a small piece of meat on the tray which they will be sure to move about while pecking at it. Better pictures with kodaks can be obtained by using a portrait attachment lens, so that the camera may be put within two or three feet of the subject. If pictures are taken with the usual universal-focus box cameras, or with bellows kodaks at distances greater than six feet, the subject will appear much too small on the negative. This is obviated by slipping on the portrait lens. I suppose that through a clear glass windowpane motion pictures could be taken with the newly perfected home motion-picture outfits, without disturbing the birds. It is worth trying.

Hickory nuts, butternuts, and even peanuts in the shell, laid upon the snow, are eagerly welcomed by any red or gray squirrels in the vicinity. It is amusing to watch them being gathered in.

Grasshoppers

If you have never tried it, you may be surprised at the amount of entertainment for a group of children that can be had with common grasshoppers. Especially are they good material for youngsters to "cut their eye-teeth on." That eye is suddenly opened to a number of things it had never noticed before. "Why I thought they was on'y *bugs*—like any udder bug!" exclaims one ten-year-old girl after two days of field and lens. "I never knew just grasshoppers had so much to 'em as that!" comes from an older city-miss, in the course of a pasture-talk. "A week ago you couldn't have hired me to hold one of them things—now I'm keen about 'em!" puts in a neurotic "problem child." "I never knew insects didn't have lungs," confesses a high school boy who prides himself on his hunting wisdom. "I won't never kill no more hoppers," volunteers a shy country lad, after we have sat down and considered them for half an hour.

Such offerings, forthcoming whenever we have taken up grasshoppers, lead me to wonder if

teachers in general are aware of the possibilities in such humble game.

It is a September project: grasshoppers, the true locusts, are everywhere. Just ask each of your group to bring, in a mason jar, ten of his own catching: you are off! First there will be the different varieties to discuss. Then the sex question—which is which? Eyes, "feelers" (did you know that each segment gives the insect a separate kind of information?—this has been proven on ants), mouth adaptations, "molasses" (from its crop), tympanum (an ear—but Cousin Cricket hears with his elbows!), wings and coverts (which it can use only after its eighth and last skin-shedding), leg structure, breathing holes, "song" mechanism, ovipositor: it is a whole insect laboratory.

Here and there a nymph has been brought in. This puts us on the track of life-history. Someone has caught a "meadow grasshopper" as well as the "shorthorn" or locust grasshopper. Are its "ears" the same, or on elbows, too? And how does it chirp? Deposit eggs? Has someone found an egg-mass in his jar? . . . Soon we are face to face with insect generalizations; have heard the words "larva," "pupa," "metamorphosis," "exo-skeleton," "economic importance," "nymph," "thorax," "abdomen," "spiracles," and the like. We have

used our hand-lenses on everything in sight. We have realized that the commonest of creatures is extremely complex and worthy of observation. We can never be quite the same again after Grasshopper Week!

Did you ever try putting the insects to be studied into little glass vials so that each child can use his eyes and lens to best advantage?

Schoolroom Pets

At the little red schoolhouse, and at more pretentious edifices of learning as well, Mary's lamb was not in times past a welcome guest. Times and manners change. Nowadays in modern schoolrooms, teacher and pupils can't seem to get enough wild life to watch and love. Dogs are common companions. In some progressive schools, tame bunnies hop around the floor or munch their vegetables contentedly in a corner. Guinea pigs, caged or at large, are not uncommon tenants. Albino white mice, as well as their more normal cousins from field and pantry, have their boxes right in the thick of things. And no lightnings from on high descend to strike the teacher down! The week-end feeding problem is by far the hardest one for a school group to solve: the rest is simple. As Guinea pigs are easy to raise and keep, they are numerically favorites.

An unusually successful experience with these little rodent "pigs" developed under my supervision when each pair of eleven-year-olds took unto themselves a pair of Guineas. They bought a pair they fancied and, in order to simplify the rooming question, each two children made cages of the same

dimension and type. With an eye to easy cleaning and easy access to the interiors of the cages, and also to stacking them up one upon another when occasion required, the pens were constructed as follows:

Planed, inch pine boards, twenty inches long by eight wide, nailed together at the ends, formed the sides of the square cage. The bottoms were left open; the tops, constructed of boards of the same thickness, fitted inside the sideframes, and rested on cleats fastened inside the frames on two opposite sides. One of the two (or three) boards comprising the tops was hinged with two little brass hinges lying flush with the tops of the side-frames. (The use of this thick boarding made the tops safe from warping and made them shut down heavily enough so that the inmates could not nose them up and climb out.) Now from one side of a cage a rectangular piece was sawed, leaving two inches of that board along its top. Half-inch mesh wire was tacked over this opening.

Under the cages was placed a ten-page thickness of common newspaper. This paper floor was changed daily and the pens were always clean.

Although they can squirm into surprisingly

small crevices when liberated, Guineas never offer to bite and indoors can be readily caught at will. Litters were born frequently; the group watched eagerly for their coming, and adored the babies. In winter their menu comprised hay, uncooked vegetable scraps from the kitchen—few seem to like cabbage leaves—and lettuce and spinach "trimmings" from the groceries. In summer, the cages were simply set up on the grass round about, and the animals allowed to forage for themselves. To protect them from stray dogs, the cages were held down by heavy stones. When a mother was about to have young, we removed the male and separated the pair until the babies were a week or so old. It is often contended by pet dealers that these animals do not need water. But they drink as often as any other animal, although they can apparently do without water for several days without discomfort, utilizing the juices from their green food. Shallow water-dishes they never tip over, high-sided ones invariably. Fastened cups become too dirty to be desirable. A mother carries her young six weeks. The babies will eat grass the day after they are born, and can run about as actively as their parents.

For the youngest children, a hen sitting upon her eggs will prove of interest. She will require

only a stout box-coop with wooden slats nailed across the front. This combination of hen and eggs, preferably in their last week of sitting, can be gotten from almost any farmer or poultry-raiser. The hen will want to come off her nest daily, to eat and take a little exercise. Great care must be taken not to scare or fluster her, else she may desert her eggs. Usually a sitting hen will get used to her surroundings in a day or two. For several obvious reasons, this pet may be kept out of doors on the school grounds. If the nest is set inside a large box, she can get enough exercise during the last week of brooding without coming out. The chicks, after they emerge, need not be fed at all for 48 hours; then follow the directions of the owner as to their care. The brood should be returned to its home farm after a week or so, unless the facilities for raising them are ample. A Plymouth Rock or Rhode Island Red hen is a much more placid mother than the Leghorn type. It is, of course, much better if you can provide a temporary chicken-wire run outdoors for the family, shutting up the hen in the box for the night.

A variation of this scheme is a hen brooding duck eggs. Ducklings are even more irresistible to children than chicks and, while they are still very

young, shallow pans of water will suffice them to dabble in. We have found farmers very willing to coöperate with us in these schemes, and their suggestions as well as their aid have been invaluable.

We have written elsewhere (page 20) about nestling crows as pets. Young Red-shouldered Hawks also can sometimes be taken from nests and reared as pets. They are harder to provide food for, as they are meat-eaters solely, and are much less canny in adapting themselves to captivity. By tramping the April woods before leaves are out, while hawks are sitting, a nest is easily found. One looks for them in the same localities and trees that crows frequent, and at the same time of year. Indeed, they commonly repair and use an old crow-nest, preferring maple, birch and oak sites to those in evergreens. Rapping sharply on a trunk with a dead branch will usually cause any crow, hawk or owl to fly from its nest. Mid-May when the young hawks are half grown, is the time to get them. If a tree cannot be readily scaled a pair of lineman's climbers borrowed from a friendly workman will enable any strong boy to do the trick for his school. At about the same time, red squirrel babies, which also make good pets, are frequently housed in such nests, instead of the birds sought.

I once had a friend who obtained an old showcase from a local store and by use of a simple waterproof putty made by working litharge powder and linseed oil together, made an admirable aquarium of it. His example can readily be followed in the schoolroom.

Aquariums are of two sorts, the "balanced" and the running-water type. The first, by virtue of water plants, snails, caddis fly and dragon fly larvæ, is so oxygenated and scavenged as to keep going indefinitely. If running water is handy close by, a plumber can tap into it a small cock with a tapering end from which, by means of rubber tubing, water can be conveyed anywhere in the room. A bent copper tube of such material as is used for automobile gasoline-lines, will serve as an outlet or waste-siphon from the aquarium. In many school houses, this waste-pipe can simply discharge through a hole bored into the floor. Perhaps a regular waste-pipe connection can be made with the plumbing system, or the water led into the sink. The running-water aquarium * need be kept running only during the daytime; it can be turned off

* An "automatic" siphon which can carry off more water per hour than is run into the tank, but will flow only when a certain level is reached, can be made by the physics teacher. See page 331 in *Insect Life* by Comstock.

at night. A running-water aquarium is better for brook fishes, and is less likely to accumulate algæ discoloration on the glass, since it need not be placed in strong light. A series of battery jars, or other small containers, connected by glass-tube siphons can also be planned, each holding a different kind of inmate—groups of tadpoles, or baby fishes of different ages—one stream running through all. I have even used meat-roasting pans, painted inside with several coats of white enamel, as aquariums for fishes. If below the level of the eye, they are very attractive. Several excellent books on aquariums that will tell you all you need to know about their management are mentioned in the bibliography at the end of this book.

Canaries, having been wonted to confinement by generations of domestication, are not hard to keep healthy in the schoolroom if the cages are roomy. They will commonly build nests and breed in captivity; and, of course, they fill the place with song. A pair of Canaries, even if they do mate, often show great difficulty in getting along together. There may be two reasons: first, that they are not *naturally mated* birds; and second, that continuous companionship is not natural for them. In a native state their kind do not take mates for more than

one season, and hence living constantly together sometimes wears on them as it does on some human beings. Large and high, though not necessarily deep, wall-cages afford them much more exercise than the usual house bird gets. But such cages should be set where sunshine will reach the birds at some period of the day. Dead branches, fixed upright in high-topped cages, add to their happiness and to the attractiveness of the cage. Canaries need a diversified diet which should include green leafage, sand, cuttle-fish bone, and occasional hard-boiled eggs, as well as rape-seed, bread and grass-tops. Materials for nest-building should be supplied when they show signs of wanting it. Water for bathing as well as for drinking purposes is, needless to add, essential. (Our common native Goldfinch is a close relative of this bird.)

It often happens that a mother White-Foot Mouse, Field Mouse, or House Mouse is discovered and captured with a litter of tiny young. By providing as a cage a box which has very tight corners and close-fitting edges, so that they cannot gnaw out, you can raise the brood in school. Mice may easily be caught in the house by using any of the traps which catch them alive, and then kept in schoolroom quarters. Trapping wild mice, by means

of an ingenious little device not hard to make, will usually intrigue some member of a group. Take a strong piece of reed of sufficient springiness, or a limber and peeled twig about a foot long, and bend it into a loop. Let the ends project for an inch beyond where they cross, and then tie them at the point of crossing with a strong string. Now place a wide earthen bowl with one edge resting on the ground and the other on the middle of the loop. The strength of the loop must be such that it will maintain its somewhat oval shape. The lower side of the loop of course rests on the ground—or better yet the trap can be set on a flat stone or board so that the mouse will not dig himself out. Wedge the bait, a crust or a piece of cheese, upon one of the pointed ends of the twig, or between the two ends. When a mouse shakes the loop by nibbling the bait, the bowl slides down off the round end of the loop and imprisons him. The bowl used must be arched enough so as to clear the loop's top as it falls to the ground. By sliding under the bowl a sheet of tin or thin board, the catch can be transported to school.

Mice are astonishingly capable of gnawing their way out of any cage where they can get the least start with their teeth. And they bite in a flash! Therefore handle them, if at all, only by the

loose skin at the back of the neck, first catching them in folds of cloth or with a leather glove. They may be caged in pairs and will occasionally breed in captivity.

(Snakes, bees, ants, "fishless aquariums," and the vivarium, are discussed elsewhere.)

Frog, Toad, and Salamander Eggs

WHAT is more fascinating to watch than a series of bowls and glass jars developing tadpoles! The whole history of batrachian life lies before you, eggs to débutante. Yonder across a broad window, just above eye-level, is a shelf on which rest five battery jars each with a different life-stage of the frog. The jars may be at rest, but their contents are not. At the left end of the line is a recently gathered cloud of jelly in which are embedded a hundred black and white balls. As you watch from day to day, form and complexity develop in those balls and presently, some morning, a child shouts: "Oh, there's a pollywog coming out!" In the next jar are tadpoles a week older. In the next some half-grown Bullfrog tadpoles, born in the pond a year ago, are in active motion. Another jar holds others in the four-legged stage, tails nearly absorbed. The last may have a few tiny adults of the Cricket Frog or Pickering's Hyla.

Perhaps you may also have some Spotted Salamander eggs, which you can find in a swamp-hole earlier than the frog eggs, and these may likewise be evolving after their fashion. Perhaps a toad's

strings of gelatine, strung with black beads, are hatching into black wigglers, later than the frog's eggs. What wonderful material that pond offers you! Any time between April and July, a wade and a "snoop" in a swamp or weedy pond will be likely to yield some sort of eggs or tadpoles. The Wood Frog, the Hylas, and most of the Salamanders, lay very early; next, the other frogs; and latest the Common and the Fowler Toads.

Keep different species of eggs in separate containers. One- and two-quart fruit jars are almost as good as battery jars. Soon after frog, toad, or salamander eggs of any species—the Spotted Salamander's globular masses are easiest to find—when they are hatched, remove a few to a clean jar for a permanent home. About five to a quart of water is all that can properly maintain themselves. For their food supply, follow these directions: In the first place, use pond water to fill the jars, and also place a thin layer of pondfloor mud upon the bottom. On this set a stone or two, also from the pond, selecting those which are somewhat covered with slime, and under one of the stones catch the root-end of *one* slender green water plant with vertical stalk just long enough to reach to the surface. So caught, it will maintain its upright position. Mud, slime, weed, all are food. One dead

leaf, carefully brought up from the bottom so as not to disturb the tiny creatures on its underside, will likewise carry a little food supply. Every two or three days, replace these stones and the leaf with others and add a fresh teaspoonful of mud. When your small fry get larger, offer them once a week a small piece of boiled egg-white crushed into minute particles, and occasionally a bit of pulpy plant stalk pounded into a mash, though if a few leaves of duckweed are kept floating on the surface, its tiny hanging rootlets afford a substitute. Full grown batrachians (*amphibians*) eat angleworms, meat scraps, ant eggs and insect larvæ.

If aquariums are exposed directly to sunlight or nearly so, algæ cells will soon develop and cloud the water with a murky green. By far the best location is at the level of the eye where the contents can be readily observed, and in front of a north or east window. Always keep the water as cool as possible. As elsewhere pointed out, a painted metal or an agate dish may be used as a makeshift for jars of glass. Two or three pond Snails make a satisfactory addition to a tadpole aquarium, and perhaps an Asel and a Caddis.

If a bucketful of water is set outside for a few days, mosquitoes will drop eggs in it and it will soon be lively with the "wiggler" larvæ. These

wigglers, scooped up with a fine strainer, make excellent food for big tadpoles, for fish, and for many of the lustier insect larvæ living on an aquarium floor.

When tadpoles are four-legged (the Bullfrog and Green Frog young require two summers) and their tails are rapidly vanishing, they like to climb out of the water and float upon a chip. They will jump out, too, unless a netting cover prevents. Toads usually outgrow an aquarium sooner than frogs. Adult Frogs and Salamanders must be kept in a vivarium (or terrarium): for suggestions on making this, see page 273.

School Forestry

A LIVE project involving responsibility and carry-through for more than a single year, and a task of some social significance as well as economic value, is a project in foresting. For a school, foresting may be made an investment; not a heavy one, and one in which the risk is overbalanced by many advantages of a non-financial sort. Although it has not been attempted, so far as I know, by any private school, there is no valid reason why it should not be analyzed and considered. Boy Scouts and several other organizations of a similar nature are carrying out such projects in parts of the country.

An area of several (preferably less than five) acres in a secluded spot has to be acquired either by outright purchase, upon part mortgage, or upon a fifty-year lease. The soil does not need to be good for agriculture, for it is waste land, old pasturage and "thin" meadows, whose use for reforesting is urged by state experts. Such land in many sections of the East can be bought for $50 an acre or less. Some of the states, including New York and Massachusetts, exempt such land from taxation under certain conditions, if it has been planted.

The former state provides free seedling trees if state supervision is allowed. Perhaps inquiry will disclose that other states have established like policies. In addition to a foresting project, an acreage thus acquired may serve as a place for schools to hold outings and field trips, as a country environment in which to study nature, and possibly as a summer camp site as well.

The writer has had considerable experience in reforestation, having set out at least 20,000 trees in different localities in New York State, and hence is thoroughly familiar with the requirements of such work. A school embarking upon a reforesting project need not plant more than a thousand trees each spring. All the actual labor can be accomplished by faculty and children; it is a man's job to make the holes, but a child's work to plant the trees. The first-hand, responsible, educational values to youngsters from such a sincere piece of conservation are obvious. The reforested area stands permanently as their accomplishment. As the land and its trees grow in beauty and money value with the passage of time, the continuous project year after year breeds nature lore and country-mindedness as well as it does timber.

In some places, the land may have to be cleared of brush, vines and small trees. These may be

cut by members of the teaching staff with a hatchet, mattock, bush-hook, or brush-scythe. Such work is not too heavy for a man or strong woman, if not kept up too long at a time. The clearing need not all be done at once. Sections can be cleared from year to year as progressive plantings are made. The children can drag away and pile the cuttings where they can be burned when dry the following season. Before starting either clearing-off or planting, the plot as a whole should be burned over in April. It cannot ever be burned again without endangering the newly planted trees near-by. Of course great caution must be taken to keep the fire under control. Before starting the fires, get help and advice from neighboring farmers, and have plenty of assistance at hand with wet burlaps, brooms, and mops for emergency. In most states, one who sets a fire is liable for resulting damages. In certain sections, permission must be had from the local fire warden. Burning-over kills a vast amount of impeding blackberry bushes, dead grass, vines, etc. These may come up again, but the temporary leveling will give your trees a good start.

The only two dangers to which planted trees are liable are fire and trespassing cattle. Diseases, except rust in White Pines, are rare. Field fires in early spring and late fall are all too common men-

aces to reforested tracts. A ten-foot fireline of land annually replowed will halt such fires, and fences reasonably attended to will keep out cattle. After six or seven years of growth the fire hazard will become much less, and it will finally disappear when there is no longer any underbrush to burn.

For reforesting, "transplants" (that is, transplanted trees two and three years old) are best. We do not advise putting out the so-called "seedlings" under any circumstances, as their roots and tops are so small as to make their mortality high and beginning growth slow. When all is ready for planting, carry the little trees to the site in pails of water, and set them six feet apart each way in straight lines. Two six-foot laths nailed together at right angles, and fitted with an upright stick as handle, will help the inexperienced digger to keep his intervals regular, but after a little practice this will become unnecessary. The holes are best prepared by four or five strokes of a heavy mattock ("bog hoe") and no other tool will do this work so easily or so well.

The trees can be set by the children. Full directions as to setting them are given by the state forestry bureaus from which trees are secured, and these bureaus will further coöperate to the fullest extent. The best time to plant is during April;

the Easter vacation period often comes exactly right. A thousand per year is a good planting program.

What trees shall you plant? Choose, with the help of your state forestry bureau, from among these species: Red Pine, Scotch Pine, White and Norway Spruce. But bear in mind that there are many sections where White Pine suffers greatly from rust and the attacks of a boring insect. The two first species grow fastest and on the widest variety of soils. Since you may be able to sell every alternate tree after six years, either as nursery stock to be removed by the purchaser, or, if spruce, for Christmas trees, these considerations may determine your choice. It is not necessary, however, to remove each alternate tree until they have grown fifteen or twenty years. Scotch Pines grow on the poorest soils, but do not sell as readily for ornamental purposes, and produce lumber of lower grade. Several varieties may be planted if desired, but they should not be mixed together. Transplants cost but four or five dollars a thousand from state nurseries, and are expressed to the nearest railway point. They are packed in wet sphagnum moss in bundles of fifty and, if the roots are "heeled" into wet mud as soon as received, they may be so kept for three weeks before being set out. They occupy

an astonishingly small space in shipment and weigh very little; a box holding a thousand can be easily carried by one person.

Replace each year any trees that may have died. An acre planted six feet each way takes about a thousand trees, of which not over fifteen per cent should die. After six years, the trees should be about five feet high; then they start their period of greatest growth—a foot or more per year. Five thousand straight, tall, forest trees are worth a lot of money; your waste land has become a prize! *

But suppose a school merely wishes to plant evergreens on a small scale on and around its premises: this, too, has a strong appeal as a project for the children. The several state nurseries do not as a rule supply stock for ornamental planting. Such trees must be bought from a nursery house, but, if secured in lots of fifty, at three years of age, should not be expensive. A common mistake in planting evergreens such as pines, spruces, tamaracks, and balsams, which in ten years will grow to large trees, is to set them out too close to buildings and walls. Only cedars should be set thus, or fancy dwarf varieties from nurseries.

* The U. S. Department of Agriculture, Forestry Service, Washington, D. C., will send you pamphlets on foresting and so will the several state bureaus.

Evergreens do not require any soil enrichment; indeed they grow handsomer without it.

Plant as soon as all frost has left the ground. Give the rootage, even of seedlings, a hole so wide and deep that it is not cramped, although roots may safely be pruned back a few inches all around. Uncramped rootage will produce a far better top growth the first season. If you are setting out a tree of any size, *plant it in mud* and tie it with cloth bands to a supporting stake to prevent its roots from being loosened by the wind before they take firm hold.

Making "C'lections"

A TEACHER once remarked that every child she had ever known could become interested in making some sort of collection if she could succeed in hitting upon the right thing to suggest to them. Stamps, trolley-transfers, post cards, coins, animal bones, advertising-match clips, poster and car-card slogans, freight-car names, auto names, marbles, celluloid buttons, ribbons, are some she mentioned as "taking." In the realm of nature study also the field is rich. Here are a few subjects that we have known to assuage that "c'lecting" urge:

Ferns. (These are easy to preserve by pressing between leaves of old books.)

Skulls of birds and animals, picked up in field and woods.

Seashore shells.

Cocoons.

Stones and mineral specimens.

Galls. (The odd shelters for Gall-fly eggs and larvæ produced by the trees and plants within whose twigs they are laid.)

Aquatic creatures from pond and brook, kept in little individual containers made from

fruit jars serving as miniature aquariums, or all together in one large aquarium.

Tree and shrub leaves (which after being dried flat between book pages can be mounted in loose-leaf notebooks by means of narrow gummed-paper straps).

Animal tracks, from mud and snow, drawn in notebooks (with appropriate labels and notations.)

Pressed wildflowers.

Moths and butterflies. (The technique of this work demands some study and skill.)

Other insects. (Easier to achieve good results with than the foregoing, as a cyanide bottle, thin mounting-pins and a net are about all that is required. To make a satisfactory insect net, cut off a broom- or mop-handle and bore a quarter-inch hole three inches deep into the end. Now bend into a foot-wide circle a straight piece of No. 10 telegraph wire, overlap the ends about three inches, and twist them together. Insert this end-twist tightly into the bored hole and pour in melted lead around it. If lead is not available, use as a substitute a paste made by mixing glue and sawdust, letting it harden for a day or two after

having been inserted. Finally sew on a bag of netting by means of twine or stout thread.)

Bird, animal, reptile, flower, and insect pictures, colored and uncolored, mounted in scrap-books, with some attention to family and genus. (In one group I know, each child chose a different animal family to collect.)

Seeds. (These can be displayed nicely in glass vials or test-tubes. A unifying interest topic for such a collection might be, "Ways in Which Plants Disperse Their Seeds." Nuts, seedpods, and fruiting heads of plants come naturally into line with this pursuit.)

Birds' nests (collected after having served their natural purpose).

Snow-flake designs sketched from flakes caught during snow-falls out of doors upon black surfaces and observed through a magnifying glass.

Fossils.

As a stimulus to nature interest, nothing can compare with plenty of such specimens as these in the schoolroom. But if the children prefer to keep their collections at home, they may be induced to bring occasional bits to school to edify their fellows.

The Overnight Hike for Children

ANYONE who has engineered an "overnight hike" for children (the phrase has come to have a technical meaning among camp directors), accompanying the party from beginning to end, needs no urging to conduct others nor advice on how to proceed. But comparatively few persons have carried out overnight hikes for private schools—and families! —in spring and fall. Summer camps do their share, but the joys of spring and fall seasons are neglected.

True, nothing but experience can give the confidence and the expeditious, business-like skill in getting ready which make the "stunt" so easy and which is based on a carefully compiled checklist of everything to take along. One's experience in overnight hiking is concentrated in that checklist! It is invaluable. Everyone who has made such hikes and expects ever to do so again should make one. Here is offered a list which the writer has found to be useful and which ought to be of service to those who "wish they knew how to start." The list naturally falls into three parts: (1) what each pair of children carry for themselves, (2) what is taken

for the group, food excepted, and (3) food items.

This list assumes that all outfit and food is to be carried by the hikers, that the children range from ten to fourteen years, and that they are to sleep without tents and remain from home not more than two nights.

I. For *each pair* of children to take besides the clothes they wear: *

Pocket mirror.
Comb each.
Toothbrush each.
Toothpaste.
Towel each.
Pocket-knife, a good one and sharp.
Two blankets, one heavy and one lighter.†

* Children should wear their oldest clothing, light underwear and a warm shirt, and carry a fairly heavy sweater to take off and put on as the weather may require. Two pairs of socks, one of thin cotton or silk next to the skin, and the outer pair heavier, make walking easier in all weathers. Take ordinary shoes, well-broken and comfortable. Beware of the high-topped, heavy "walking shoes" (so-called!), for they are usually stiff, hot and heavy. Long-legged trousers—yes, even for girls!—are better than knickers if you are going amongst briers, mosquitoes or blackflies. Puttees, worn with knickers, are all right if they are not insufferably hot to walk in. Everyone should sleep in full day-costume, except shoes, if the coolness of night requires it.

† To make a bed on the ground for two, or even three, together, select a grassy or sandy spot, level, of course, and clear away the stones and sticks. If hay, dead leaves, or balsam and spruce boughs are handy, spread them down as a mattress—do not use hemlock, pine, or cedar twigs for this purpose, they are useless. Next, lay a poncho, outside down. Arrange one blanket

Poncho each: to meet possible rain while walking, since it is not advisable to allow the children to get soaked and to dry later. Each should also carry one of the modern, extremely thin and light *raincoats;* slickers are too heavy and clumsy. In lieu of a raincoat, a second poncho will do. Ponchos should be the wear-over-head kind, of the lightest possible quality.

Two yards of white (not dyed) mosquito-bar, or cheese-cloth if blackflies will be met.*

over the other and pin them together and to the edge of the poncho at intervals to keep from slipping. If you have a second poncho or raincoats, spread them over to keep off dew and for warmth. If it is necessary to guard against mosquitoes, cut two Y-shaped sticks about as thick as your thumb and about two feet long. Trim these off an inch or two above the crotch. Drive this into the ground so that a third stick laid across from Y to Y will pass directly above your heads to form a frame over which to drape the mosquito bar or cheesecloth. Work at this until not a chink is left open, and so fix it that it cannot touch your faces. Pin it to the top blanket to prevent it from slipping in the night, and fasten the rear end to the ground by stones or a long, heavy stick.

* Blackflies rarely appear outside the mountain woods or foothills, and are gone as a rule by July 15. They are very troublesome while they last, as their bite is poisonous and they will crawl up under clothing and down into shoes. They cease all activity at sunset. Midges are so tiny as to be hard to see; they will crawl through anything, day or night, and are the perfect sleep-murderers! They prefer shade and deep woods. Citronella frequently applied will drive off most of them. By August they have mostly disappeared. They will never be encountered in the open, far from damp woods. Mosquitoes, not very numerous before May 20, are few by the middle of August. As the season advances they are apt to develop progressively smaller, so that they occasionally get through ordinary netting. Bobbinette, marquisette, or any finer mesh netting are better than the ordinary kind. Do not take children on hikes unless prepared to give them a good night's sleep, with protection against insect pests.

Rucksack each, of waterproof material.
Two drinking cups, handled, non-collapsible, to be used for meals also.
Canteen, unless you know that water en route is available.
Six paper plates.
Knife and spoon (fork?—no!).
Dozen paper napkins, which are also useful to clean plates and cutlery.
Supply of toilet paper.
Pair of sneakers each, for change of footwear occasionally.
Pair extra stockings each.
Six assorted safety pins each.
(An army mess kit, made of aluminum—combined plate, fry-pan, soup-dish, etc., holding knife, fork, and spoon—which is not costly, is ideal for each child to take *if he has one*. Children need not be put to the expense of buying mess kits as they are "frills" for this type of walking, but they may well be made part of the permanent equipment of a school.)

II. To be distributed among the group's knapsacks or rucksacks:

Two rolls surgeon's adhesive tape.
Two or three rolls 1 inch gauze bandage.
Matches in sweat- and rain-proof container.
U. S. Geological Survey map of region to be visited, mounted on cambric.
Spool of light copper wire.
Several yards of cord or heavy twine.
Can opener.
Cooking utensils, number and character to be determined by food taken. Don't take anything not strictly neces-

sary. Take cloth bags or newspapers for soot-blackened utensils.

Light scout ax, for firewood and emergencies.

Four-ounce bottle of citronella (if needed). This will be sure to leak or be spilled if carried in vials individually.

Two or three flashlights.

Manicure scissors, for neglected toe-nails.

Field glasses and hand lenses.

A few large, strong paper bags.

Two or three wire grills (provided you take food which calls for their use), to lay across improvised cooking-arches of stone. Gas- and oil-stove shelves are perfect for this. The legged kind which you can buy are heavier to carry.

A supply of cathartic pills, as hiking often causes temporary constipation. Drink plenty of water, as a large amount is thrown off as perspiration while walking.

III. Random food suggestions:

The food problem for this kind of hike is wholly solved by the endless choices in packaged staples. Work out menus and quantities in advance, so as not to take too much. One widely held fixation, that each meal must be an absolutely balanced diet, can be quite disregarded for short hikes. Use mayonnaise jars with tight covers for such things as salt, sugar, butter, candy, etc.

Hot dogs. These should be parboiled at home, ready for broiling; otherwise they are not cooked when broiled by the children.

Hamburger steak, an ideal camping-group dish.
Marshmallows.
Sweet chocolate cakes; milk chocolate melts too readily.
Two potatoes to each child.
Half-loaf of rye-bread for each child.
Rye Crisp and Triscuit.
Peanut butter as substitute for butter, which will not keep.
Cheeses of many kinds. Limburger now comes bottled and is tasty.
Oranges.
Cabbage, onions, carrots, lettuce, cucumbers, all for raw salad, with mayonnaise.
Bacon, the old stand-by.
Anything canned. (Each child can carry two cans of something.)
Hard-boiled eggs, cooked in advance.
Postum, cocoa, tea. Boiling water may be mixed with any of these, in individual cups or glasses to make quick and tasty beverages.
Condensed milk, to add to the foregoing.
Eggs, milk, and bread, usually to be bought en route.
Assortment of package biscuit products, a different one for each child to carry.
Salt, sugar, pepper—don't forget them!
Raisins, figs, dates, fig newtons, raisin crackers.
Macaroni and spaghetti, which cook quickly and are "filling."
(On Page 190, tramping is discussed with different requirements in mind, but some of the suggestions there given will be found helpful on overnight hikes for children.)

When all the material is ready, assemble it on the grass and parcel articles out to the circle of

hikers, each according to his ability. Check each child to see if he has everything under List I. *Then*, and not until then, *pack* for the walk.

One warning to convoyers of juvenile hikers for the first time is: don't go too far. Few children have learned to love hiking for its own sake; they prefer the camp part of it to the walk part. Tired-out youngsters, overladen and footsore, do not have a very good time. The length and venture of the hike may be gradually extended in subsequent trips. Another: the hike can be only as far and as swift as the weakest unit can go. For the sake of all the others, leave "babies," who are wont to complain and feel sorry for themselves at every opportunity, at home. Also leave behind real weaklings whose physique is not up to par and who are likely to cause anxiety and hold-ups unfair to the rest of the party.

Such knick-knacks as compasses, fancy hatchets, hunting-knives, flashlights, bugles, whistles, heavy belts, and similar paraphernalia, which certain quasi-military boy's organizations have taught boys to carry on every country walk, will be likely to crop up in abundance. If the boys are already well-loaded, they should be advised against taking such things along as, on a long walk, weight really counts. A book to read in the evening around the

fire is a great asset, and a musical instrument or two pay for the added weight by the pleasure they give.

Few clear streams well away from human habitations are dangerous to drink from, and any water thoroughly boiled will do for cooking. Water boiled in the evening, and allowed to stand overnight, will be ready to drink next morning for breakfast.

Hikers in May and September will be practically free from insect pests, but an extra blanket should be carried. For October hikes, each pair should take four blankets and two ponchos, the second one for warmth.

Some School-made Contraptions

Vivarium. For keeping live frogs, salamanders, snakes, mole crickets, and certain burrowing insect larvæ, and possibly moles and shrews.

Make the side-walls of inch pine boards of any desired perimeter, but preferably not over a foot high. Tack upon the bottom a sheet of stiff tin. Hinge a top cover of fly-screen on a light frame, the full size of the top. Spread any loamy earth to a depth of three inches over the bottom, except at one corner where you should set a square-sided cake-tin to hold water, and pack moss around it to conceal its edges. Paint both vivarium floor and water-tin several coats of either an outside-white or a dark-green paint. Also paint the boards both inside and outside a dark color. The earth should be sprinkled with water through the cover every day to keep it continually moist. If a jet of running water can be arranged with an inlet to and outlet from the water-dish, it will be much cleaner and nicer for the inmates. Lay broad flakes of moss from woodland boulders so as to cover nearly all the earth surface. . . . Or, instead of the above, a fairly satisfactory vivarium can be fashioned

from a large roasting-pan or maple-syrup evaporator, thoroughly painted to prevent rusting. Here also a water-dish similar to the above is necessary . . . Feed inmates on such things as worms, ant-eggs, insects, chopped-meat particles and bread-crumbs, according to the needs of the animals caged. A panel may be cut out of one or more of the walls if desired, and covered with wire screening.

Box Trap. For catching live rabbits, chipmunks, skunks, woodchucks, squirrels, rats, and the like.

Use 1-inch planed stock. On a bottom-board, 8 x 16 inches, build a three-sided box 8 inches wide by 16 inches long and 8 inches high. For the fourth side, nail a board 6 x 7 inches to the end of a *top* board, 6 x 15 inches, which will fit loosely down into the open top of the trap. These two walls, joined into one piece, are to fall down into place (forming a closed trap) when the trigger is sprung.

To make the trigger and bait-holder, bore a half-inch auger hole through the rear side, two inches from the bottom (and in the center line). Through this hole insert a wooden meat-skewer eight inches long, on the point of which to impale the bait. Lightly notch the other end on its upper side close to the extremity. Set a light piece of

wood (about as thick as your finger and 2½ inches long) pointed flat at each end, lightly into this notch and into a slit cut in the rear of the trap, about two inches above the hole. Locate this second notch according to the length of the trigger: if it "works," it is correctly located. A very slight movement of the bait-end of the skewer will cause the trigger to jump out of these notches, and so release a string tied to its middle which has been holding up the cover. This string passes from the middle of the trigger up and over a thin strip of wood nailed to the back of the trap and projecting about seven inches above it; thence carry it forward and make it fast to a nail in the forward end of the top. Make a smooth notch in the top of this strip of wood, to allow the string to slide through easily. To make the top-and-front-end piece swing up and down easily, drive two long nails into the rear top angle of the two side boards and through into the top-piece, so that it will drop smartly shut the instant the trigger is sprung. Adjust the length of the string so as to allow the bottom of the front side of the trap when the trigger is set to hang just at the level of the trap-top. Bait appropriate to the animal sought must be wedged or tied tightly to the skewerpoint. (Don't

leave your animal trapped any longer than absolutely necessary!)

Insect Cages. For keeping or rearing insects which live on plants.

First transplant the grass or other plant on which the particular insect is to feed in good earth in a large flower pot, just as if it were to be grown for its own sake. Now set down into the pot a lamp chimney or lantern globe, the bottom of which is of a size to fit firmly between the earth and the sloping sides of the pot. Lay a piece of fly-netting over the top, and your cage is ready for use. The plant will grow nicely in a sunny spot, and will provide food and a home for any kind of insects accustomed to feed on it.

Osmosis Exhibit. For demonstrating how sap rises in roots and stems against the pull of gravity.

From the large end of a fresh hen's-egg remove very delicately an area of shell equal in circumference to a quarter of a dollar, but *without puncturing the lining of the shell.* If you fail, try another egg: it is not an easy feat. Then with a long pin pierce a pinhole in the small end of the egg, thrusting the pin well into the egg-yolk. Now take a small-caliber glass tube about two feet long, having a perfectly smooth end, and fasten such end over the pinhole with melted sealing-wax, so that

it points straight up from the egg. With adhesive tape, secure a loop of string to the top of the tube in order to suspend the tube and egg thereby. Thus suspend the egg so that about half of the large end swings freely in a tumbler of water. The osmotic interchange of liquids between the egg contents and the water will, in a few hours, cause the egg contents to enlarge and slowly push upward to the top of the tube.

Rain Indicator. Cut from white blotting-paper any sort of fancy flower or animal designs, and paste them upon cardboard pieces to hang up. Stir into an ounce of water as much cobalt nitrate crystal as it will dissolve and, with a dropper, lightly saturate certain parts of your blotting paper designs, and hang where outdoor air passes. When the air is humid just before a rain, the paper will turn pink; when the air is fairly dry, it will show pale blue.

Magnifying Box. To hold objects and insects so that they may be studied easily. Fit any lens which is without a handle into a round hole in a light piece of board large enough to cover the top of a little tumbler or glass cup whose top to bottom distance is just the focal-length of your lens. Lay the board containing the lens upon the tumbler rim. If desired to make one to carry about with you,

place under the bottom of the tumbler a second piece of board the same size as the first, and hold them tightly to the glass by means of two strong, flat, rubber bands. Paint the bottom board glossy black to bring the object inside the tumbler into relief.

Concrete Bird Bath. Two dishes for molds are required; the larger can be a common white enameled wash-basin, new and shiny; the smaller can be a large and deep porcelain cereal dish or something similar. Drive a large iron spike through the bottom of the wash-basin and move it around enough so that it will slip out readily. Then set the spike into a hole in a plank far enough so that its head projects up through the basin bottom as far as the bottom of the inside mold. When the concrete is poured the inside mold should set down into it far enough to allow about one inch of concrete beneath. The concrete is to be poured into the lower mold (the basin) and the upper mold forced down into it until the level thus made is at the top of the basin. Grease both molds with vaseline or tallow before using. Mix up cement powder with three parts of coarse quartz-bearing sand containing no pebbles, and enough water to make it as thick as soup. Next day, while the concrete is still "green" and has set somewhat, lift

out the upper mold with a whirling motion. The spike, which has not been set very firmly into the wood below, should now be tapped up and out by light hammer blows, leaving a hole through the bottom of the concrete bowl. If the concrete is then hardened enough to permit the manipulation necessary for releasing it from the lower mold, remove that also; otherwise wait another day.

To set up the bird-bath a few days later, simply drive the long spike back through the hole and into the top of the post on which you wish to erect it. Use a washer or piece of copper around the nail-head to afford a firmer grip of the head of the spike upon the bath-bottom. With a putty made by mixing boiled linseed oil and litharge, or with commercial "Smooth On," or with prepared aquarium-putty, seal the leakage around the spike, and in a few hours the bath is ready for clients.

Observation Beehive. We recommend inserting a panel of glass in the rear wall of a second-hand commercial beehive, or, rather, of that part of a hive technically known as the brood-chamber. The type of construction of the hive will determine how the glass should be inserted. Such a hive can be mounted inside the schoolroom, with exits through or under a window-frame, just as a commercial observation hive would be. A suitable cov-

ering-board must be hinged over the glass panel to be lifted only for the purpose of occasional observation, as bees normally work in darkness. A former bee-keeper who has lost interest in bees may perhaps donate a hive or two, or an active one loan a hive which he is not using.

Mouse and Squirrel Wheel for Cages. Cut out with a jig saw two circular disks of inch board four inches in diameter for mice, or eight inches for squirrels; and also bore in one a hole large enough to admit the intended occupant. Bore holes through the centers of each of a size to admit tightly a stiff iron rod of the length slightly longer than you desire to have your wheel. This rod should be threaded and furnished with *two* nuts at each end so that the wooden end pieces can be fastened between them with rigidity, one nut being screwed up snugly against the *inside*, the other against the *outside* of each disk. Cut (with pliers) from the wire spokes of an old bicycle wheel pieces about half an inch longer than the proposed outside width of the wheel, having on one end the original thread and rim-nut. Having lightly nailed the two end pieces exactly together, bore near the edge at regular intervals a series of holes large enough to admit the bicycle spokes. The intervals are to be such as would not allow the occupant to escape.

Now pull the disks apart, remove rails and insert the pieces of bicycle spoke. Bend over the projecting, cut-off ends of the spokes to hold them in place, and after all are set in draw them taut and even by means of their rim nuts. If care is taken in setting the spokes evenly, you will have a firm tight wheel which will revolve smoothly, its central axis being set into holes in the cage itself.

Butterfly and Pond Net (page 263), *Bowl Trap* (page 249), *Ant Nest* (page 205), and *Aquarium* (page 246).

What One Mother Did: A Museum Laboratory for Children

In the fall of 1927, an ex-teacher mother, member of the parent-teacher group of a small experimental school in Westchester County, N. Y., organized what she named "The Children's Laboratories." To quote her, "a mother started the thing to fill what she knew to be a most urgent need in the education of her boy and his fellows . . . She felt, (1) that the hit-or-miss methods largely employed in nature study left confusion in the mind of the child and (2) that too much emphasis had been laid on collecting per se . . . The ideal of a centralized laboratory to which the children from near-by progressive schools and others might come to get a *coherent conception* of the unity of life upon this earth, a broad look at the whole field of nature, and a definite idea of where man belongs in this realm, was the stimulus which started the project of the Children's Laboratories."

As the first years of experiment actually took form, the name "laboratory" should perhaps have

been "museum"; but it wasn't quite that, either. This experiment has aroused an astonishing amount of enthusiasm throughout the whole country. Its start was modest; the first half-year saw a turnover of but $1000—a sum which did not include a salary for anybody. It was only "a little house beside the woods," in a quiet residential development two miles from the nearest school. What went on inside that little house?

"To work out this ambitious program (the 'ideal' mentioned above) a series of *four exhibits* was conceived, each to last two weeks. The public demand, however, required an extension of time from two to three and four weeks.

"The first chapter naturally was an exhibit telling the story of the earth. The story of the plants, the story of the animals, and the story of man, were the subjects of subsequent exhibits. In the case of each exhibit, the material was collected while keeping the average child's viewpoint and his interest-span in mind, but also bending all towards a *unified and systematic presentation* of the subject in hand."

The originator of this project goes on to tell how some of her "material" came from the big city museums—some mounted, some alive; how supply houses donated, rented, or sold her other setups; and how she often became painter and sculptor, too, in composing the kind of big wall-charts, "groups," and diagrams she wished to "get over" to her visitors. When her Plant Exhibit opened,

for example, visitors saw on a side wall a towering tree of plant evolution from each branch of which ran a tiny orange ribbon tied to bouquets and branches of local botanic forms placed near-by. On other days, *Paramœcium* was exhibited; so was raccoon, guinea-pig, and snake, and as many other zoo, herbarium, and geological specimens as she could secure. A microscope, a lantern-slide machine, a moving picture projector, though they cost real money, just had to be there, too.

When a group of children arrived, by previous appointment, for the place was booked well ahead, what happened to them? Let her account tell you:

"Picture to yourself a charming white cottage on a knoll overlooking fields and woods, with window boxes to make the Laboratories seem more homelike from the outside, and a huge cobblestone fireplace with a roaring fire, curtains, a rug, to furnish the homey atmosphere within. The cottage *could* not accommodate more than 20 children, the nature of the experiment *would* not accommodate more than that.

"At first I found it most difficult to have children carry the carefree atmosphere of out-of-doors into the cottage. Soon, however, they began really to enjoy themselves. Shelves which line the walls were at convenient heights, and one or two reassuring words gave them to understand that the material was there *to be touched*.

"Always one interested child attracted others. Specimens which can be picked up and freely fingered are wonderful

instruments to start conversation; "What is it?", "Where did it come from?" "Why is it here?" are questions which a group will always attempt to answer among themselves if an older person is not too ready to jump in and answer. Labels are practically all *eliminated!* Why?—In order that questions would come up easily just as those do.

"I am a laggard about entering the conversation. I attempt to be merely an interpreter. But finally the discussion ends in becoming a miniature expedition around the rooms, I telling the story of the carefully and systematically arranged charts and materials . . .

"Having completed the story as told by the material, the children squat on the floor before the waning embers and watch the screen. Whether the pictures be moving or stills depends upon the nature of the exhibit feature being discussed. . . . As *visualization* and as *summary*, the pictures most effectively clinch the whole story for them."

This ambitious and energetic lady finally concluded to charge fifty cents per child, in order to put the institution on a practical basis. This was less than the cost of a trip to the nearest city museum, a place which was for adults rather than for children.

There is no occasion here to discuss the pedagogical soundness of this method of handling exhibits, nor to question whether any four exhibits, even if ideally presented, could possibly accomplish such a systematization and unification of children's knowledge as this innovator anticipates. But there are three important things to notice about this ex-

periment—which, by the way, is to go on during 1928-29 with an even wider scope.

The first is that it caught popular attention. From being an annex to one small private school, it soon attracted the attention of others, and then that of public schools. Presently the founder was asked by mothers' clubs to give talks on sex education and physiology; she was invited to repeat her laboratory talks with pictures and charts before assemblies in public grade schools; she was begged by two of these schools to help adapt her ideas on biological education in the lower grades to their needs; finally the Westchester County Recreation Commission had heard of her work and is hoping that she may coöperate with them in the near future in a county-wide plan for camp nature study and for continuation of her laboratory-museum idea into its winter sessions as well. Also several private classes of children were organized for her to conduct courses with, which would supplement the "high spots course" of her Four Exhibits. In short, the project "took," and took widely, and now cannot stand still, but must adapt itself to larger usefulness.

The second is that there is in this project the germ of a children's nature-study and general science laboratory, in which children will make the

collections, prepare the exhibits, deliver the talks, and show the pictures. Indeed, this is the dream of the founder, who says she has merely "shown them how to start." Her unification exhibits have given to scores of children something that no school courses, and only one or two "Children's Museums" in the land, could attempt to give.

The third is that this project has succeeded in focussing the attention of a large number of adults. They found for the first time, in the Children's Laboratories, a place to learn something about nature, about paleontology, evolution, heredity, anatomy, physiology, hygiene, sex and much else which they had somehow skipped and were eager to know about. This tiny museum-laboratory has already proved that it has a place in Adult Education and is a logical and appropriate place in which to present certain courses to adults who after all are *parents*, and have more influence on children than schools can exert.*

There is a widespread feeling among progressive educators that far too much fairy-tale, myth, and literary entertainment has come out of the

* For further information concerning this experiment, address Mrs. Marguerite Schwarzman, The Children's Laboratories, Quaker Ridge, New Rochelle, New York.

recent "craze" for nature study in schools, and far too little practical good has emerged in the way of broad, vital concepts. Far too little emphasis, they are saying, has been placed upon such lore in its relation to everyday health and hygiene, and to its possibilities for broadening the *intellectual horizon* of children. Well, then, more power to such experiments in generalization! As yet, we dare not say what limits there are to the ability of youth to grasp *principles*.

Places to Buy Natural History and Biological Material

MOUNTED materials, displays, exhibits, demonstration sets, tools, lenses, microscopes, and the like, are far easier to secure than live creatures, whenever you must go to dealers rather than nature for your supply. However, the concerns mentioned in the following list of names and addresses should be able, if any source can, to supply your wants, whether usual or unusual, or to advise you where you can supply them:

General Biological Supply Co., 761 East 69th Place, Chicago, Ill.

Kny-Scheerer Corporation (Dr. LeGuy), 10 West 25th St., New York City.

N. Y. Biological Supply Co., 34 Union Square, New York City.

Knott & Co., Cambridge, Mass.

Marine Biological Laboratory (Mr. Gray), Woods Hole, Mass.

Ward's Natural Science Establishment (now run by the University of Rochester, without profit), P. O. Box 24, Beechwood Station, Rochester, New York.

Also, try your local pet and bird shops, for such dealers can often give information of great service to you.

In New York City, the New York Zoological Society (operating the Bronx Zoo), Bronx Park, New York, and the American Museum of Natural History, Columbus Avenue and 77th Street, coöperate with schools to the fullest extent, and give specific information. The Curator, The Aquarium, Battery Park, New York, will undoubtedly help you solve problems in his line.

The Industrial Arts Co-operative Service, 519 West 121st Street, New York, supplies to schools handicraft and art materials of all sorts, and can help you discover where natural history material may be found in and about the metropolis.

Book List

This short list includes books that have proved useful to the present writer. They are good books, selected with especial reference to *identification purposes*. There are many others but these will suffice, names of publishers being given in this list and omitted from the text.

If I were shipwrecked and had to jettison all my other books, those double-starred in this list would compose for me a "Desert Isle Library," a two-foot book-shelf of Nature works.

On Aquariums and Fish

The Aquarium Book. Boulenger. Appleton.

Care of Home Aquaria. Osburn. N. Y. Zool. Soc. (pamphlet).

** Fresh Water Aquarium and Its Contents. Eggeling & Ehrenberg. Holt.

The Home Aquarium. Smith. Dutton.

On Bacteria

Bacteria in Daily Life. Frankland. Longmans, Green.

Bacteria, Yeasts, and Molds in the Home. Conn. Appleton.

Story of the Bacteria. Prudden. Putnam.

Story of Germ Life. Conn. Ginn.

On Batrachians and Reptiles

** Familiar Life of Field and Forest. Matthews. Appleton.
** The Frog Book. Dickerson. Doubleday, Page.
** The Reptile Book. Ditmars. Doubleday, Page.
Batrachians of Vicinity of N. Y. City. Ditmars (pamphlet). Am. Mus. Natural History, N. Y.
Backyard Exploration. Howes. Doubleday, Page.

On Birds

Bird Homes. Dugmore. Doubleday, Page.
Bird Life. Chapman. Appleton.
Bird Neighbors. Blanchan. Doubleday, Page.
The Book of Birds. Nat. Geog. Soc.
** Birds of Eastern North America. Chapman. Appleton.
** Field Book of Wild Birds and Their Music. Matthews. Putnam.
First Book of Birds. Miller. Houghton Mifflin.
How To Attract the Birds. Blanchan. Doubleday, Page.
The Sport of Bird Study. Job. Outing Publishing Co.
What Bird Is That? Chapman. Appleton.

On Camping and Woodcraft

** The Book of Camping and Woodcraft. Kephart. Outing Co.
Book of Woodcraft. Seton. Doubleday, Page.
Camping for Boys. Gibson.
In the Forest. White.

On Earth Study

Geological Story Briefly Told. Dana. American Book Co.
Story of the Earth. Washburn. Century.
Water Wonders. Thompson. Doubleday, Page.
Wonder Book of the Atmosphere. Houston. Stokes.

On Ferns

** How to Know the Ferns. Parsons. Scribner's.
New England Ferns. Eastman. Houghton Mifflin.
Our Ferns and Their Haunts. Clute. Stokes.

On Flowers

Bog Trotting for Orchids. Niles. Putnam.
Common Weeds of Field and Garden. Long. Smith, Elder.
** Handbook of American Wild Flowers. Matthews. Putnam.
How to Know the Wild Flowers. Dana. Scribner's.
Manual of Botany. Gray. American Book Co.
** Nature's Garden. Blanchan. Doubleday, Page.
Seed Dispersal. Beal. Ginn.
Wild Flowers of New York (2 Volumes). House. N. Y. State Museum.

On Insects

A B C of Bee Culture. Root. A. I. Root (Medina, Ohio).
** American Insects. Kellogg. Holt.
** The Butterfly Book. Holland. Doubleday, Page.
Common Spiders. Emerton. Ginn.
Everyday Butterflies. Scudder. Houghton Mifflin.
** Fieldbook of Insects. Lutz. Putnam.
Grasshopper Land. Morley. McClurg.
How to Keep Bees. Comstock. Doubleday, Page.
How to Know the Butterflies. Comstock. Appleton.
Insect Adventure. Fabre. Dodd, Mead.
** The Insect Book. Howard. Doubleday, Page.
Insect Life. Comstock. Appleton.
Life of a Fly. Fabre. Dodd, Mead.
Manual for the Study of Insects. Comstock. Comstock Pub. Co.

** The Moth Book. Holland. Doubleday, Page.
The Spider Book. Comstock. Doubleday, Page.
Wasps and Their Ways. Morley. McClurg.
Wasps—Social and Solitary. Parkham. Houghton Mifflin.
Wonders of Instinct. Fabre. Century.

On Mammals

** American Animals. Stone and Cram. Doubleday, Page.
Familiar Wild Animals. Lottridge. Holt.
Life of Animals. Ingersoll. Macmillan.
Little Beasts of Field and Wood. Cram. Small Maynard.
The Pet Book. Comstock. Comstock Pub. Co.
Wild Life in Orchard and Field. Ingersoll. Harper's.
Wild Life Near Home. Sharp. Century.
Wild Mammals of North America. Merriam. Holt.

On Shells

The Shell Book. Rogers. Doubleday, Page.

On Mushrooms

Edible Fungi of New York. Peck. N. Y. State Museum, 1900.
** Mushrooms. Atkinson. Holt.
The Mushroom Book. Marshall. Doubleday, Page.
Our Edible Mushrooms and Toadstools. Gibson. Harper's.
Report of State Botanist for 1894. Peck. N. Y. State Museum, 1895.
Molds, Mildews and Mushrooms. Underwood. Holt.
One Thousand American Fungi. McIlvaine. Bobbs, Merrill.

On Nature Study

Backyard Exploration. Howes. Doubleday, Page.

** Handbook of Nature Study (2 vols.). Comstock. Comstock Pub. Co.
Handbook of Nature Study. Lange. Macmillan.
Nature Study and the Child. Scott. Heath.
Nature Study in the Common Schools. Jackman. Holt.
Outlook to Nature. Bailey. Macmillan.
Practical Nature Study. Coulter & Patterson. Appleton.

On Trees and Shrubs

Common Trees of New York. Illick. American Tree Association.
Familiar Trees and Their Leaves. Matthews. Appleton.
** Field Book of American Trees and Shrubs. Matthews. Putnam.
Forestry in Nature Study. Jackson. U. S. Dept. Agri. Exp. Sta., Wash., D. C.
** Our Native Trees. Keeler. Scribner's.
Our Northern Shrubs. Keeler. Scribner's.
The Tree Book. Rogers. Doubleday, Page.
Trees, Shrubs and Vines. Parkhurst. Scribner's.

Especially for Children

Harper's Book for Young Naturalists. Verrill. Harper.
Harper's Outdoor Book for Boys. Adams. Harper.
Mary's Garden and How It Grew. Duncan. Century.

THE

JOHN DAY

COMPANY

INC.

MAY 9 - 2001

QH81.F85
Walk, look & listen] sign posts on a nat
3 0629 0065537 9

1

5